Exhibit A

O&M CD (Including Appendices)

JEFFREY BOSSERT CLARK
Assistant Attorney General
Environment & Natural Resources Division
United States Department of Justice

GABRIEL M. ALLEN (Georgia Bar No. 740737)
Senior Attorney
DEBORAH A. GITIN (California Bar No. 284947)
Senior Counsel
Environmental Enforcement Section
Environment & Natural Resources Division
United States Department of Justice
301 Howard St., Suite 1050
San Francisco, CA 94105
Telephone: (415) 744-6488
Fax: (415) 744-6476
Email: deborah.gitin@usdoj.gov
Attorneys for Plaintiff United States of America

(see next page for names of additional counsel)

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA
WESTERN DIVISION

UNITED STATES OF AMERICA and STATE OF CALIFORNIA, Plaintiffs, v. MONTROSE CHEMICAL CORP. OF CALIFORNIA, et al., Defendants	Case No. 2:90-cv-03122 DOC (GJS) PARTIAL CONSENT DECREE (Dual Site Groundwater Operable Unit – Chlorobenzene Plume Remedy Operation and Maintenance)

XAVIER BECERRA
Attorney General of California
SARAH E. MORRISON (State Bar No. 143459)
Supervising Deputy Attorney General
CATHERINE WIEMAN (State Bar No. 222384)
Email: catherine.wieman@doj.ca.gov
MEGAN K. HEY (State Bar No. 232345)
Email: megan.hey@doj.ca.gov
Deputy Attorneys General
300 South Spring Street
Los Angeles, CA 90013
Telephone: (213) 269-6000
Facsimile: (916) 731-2128
Attorneys for Plaintiff State of California, on behalf of the Department of Toxic Substances Control

LATHAM & WATKINS LLP
KELLY E. RICHARDSON (State Bar No. 210511)
kelly.richardson@lw.com
JOHN T. RYAN (State Bar No. 211899)
jake.ryan@lw.com
BENJAMIN D. GIBSON (State Bar No. 287521)
benjamin.gibson@lw.com
12670 High Bluff Drive
San Diego, California 92130
Telephone: (858) 523-5400
Fax: (858) 523-5450
Attorneys for Defendant Montrose Chemical Corporation of California

SKADDEN ARPS SLATE MEAGHER & FLOM LLP
WINSTON P. HSIAO (State Bar No. 273638)
whsiao@skadden.com
300 South Grand Avenue
Suite 3400
Los Angeles, CA 90071
Telephone: (213) 687-5219
Fax: (213) 621-5219
Attorneys for Defendant TFCF America, Inc.

FOUNDATION LAW GROUP
GREGG D. ZUCKER (State Bar No. 166692)
gregg@foundationlaw.com
2049 Century Park East
Suite 2460
Los Angeles, CA 90067
Telephone: (310) 979-7561
Attorneys for Defendant Stauffer Management Company and attorneys-in-fact for Defendant Bayer CropScience, Inc.
and
McCARTER & ENGLISH LLP
J. WYLIE DONALD *(pro hac vice)*
jdonald@mccarter.com
1301 K Street NW, Suite 1000 West
Washington, DC 20005
Attorneys for Defendant Stauffer Management Company LLC and attorneys-in-fact for Defendant Bayer CropScience, Inc.

DLA PIPER LLP (US)
GEORGE J. GIGOUNAS (State Bar No. 209334)
george.gigounas@dlapiper.com
555 Mission Street, Suite 2400
San Francisco, CA 94105
Telephone: (415) 836-2500
Fax: (415) 836-2501
Attorneys for Defendant JCI Jones Chemicals, Inc.

TABLE OF CONTENTS

I. BACKGROUND

A. In December 1999, the United States and the State of California ("State"), on behalf of the California Department of Toxic Substances Control ("DTSC"), among other State entities (collectively "Plaintiffs"), filed a Third Amended Complaint ("Complaint") in this matter pursuant to Section 107 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. §§ 9601 – 9675, seeking, *inter alia*, recovery of response costs in connection with releases of the pesticide DDT and other hazardous substances into the environment at and from the former manufacturing facility located at 20201 Normandie Avenue in Los Angeles, California ("Montrose Plant Property"), which was operated by Montrose Chemical Corporation of California ("Montrose"). This Partial Consent Decree constitutes partial satisfaction of the claims asserted in the Complaint, as described further below.

B. In the First Claim for Relief of the Complaint, the Plaintiffs asserted a claim under Section 107(a)(1-4)(C) of CERCLA, 42 U.S.C. § 9607(a)(1- 4)(C), for declaratory relief and recovery of response costs and damages for injury to, destruction of or loss of natural resources under their trusteeships resulting from releases of hazardous substances into the environment in and around Los Angeles, California, including those parts of the San Pedro Channel area in the vicinity of the Palos Verdes Peninsula, the Los Angeles-Long Beach Harbors and the environs of Santa Catalina Island and the Channel Islands. The First Claim was settled in a Consent Decree Relating to Offshore Matters and Department of Justice Costs entered by the Court on March 15, 2001.

C. In the Second Claim for Relief of the Complaint, the Plaintiffs asserted a claim for recovery of costs incurred by the United States Environmental Protection Agency ("EPA") and DTSC in response to the release or threatened release of hazardous substances into the environment at and/or from

the Montrose Plant Property pursuant to Section 107(a)(1-4)(A) of CERCLA, 42 U.S.C. § 9607(a)(1-4)(A).

D. The Complaint specified that the Second Claim included costs related to contamination in ocean sediment at the Palos Verdes Shelf, as well as a number of specified water bodies. This portion of the Second Claim was also settled in the Consent Decree entered on March 15, 2001.

E. Pursuant to a Partial Consent Decree for Past Costs, entered by the Court on October 20, 2000, the United States and DTSC recovered $5,125,000 as reimbursement and settlement of claims for specified past response costs. In addition, Montrose had previously paid $1,354,612.37 to EPA as reimbursement of past response costs incurred by the United States with respect to portions of the "Onshore Areas," as defined in the Partial Consent Decree with Montrose Chemical Corporation of California, Aventis CropScience USA, Inc., Chris-Craft Industries, Inc., and Atkemix Thirty Seven, Inc. (Relating to Offshore Matters and Department of Justice Costs), entered by the Court on March 15, 2001.

F. Trial in this action commenced on October 17, 2000. On October 18, 2000, the Court took under submission the issue of liability of all the defendants who have entered into this Partial Consent Decree ("Settling Defendants") other than JCI Jones Chemicals, Inc. ("Jones") for the incurrence of response costs caused by the release or threatened release of hazardous substances from the Montrose Plant Property. The Parties (other than Jones) subsequently lodged and the Court entered two separate consent decrees for certain of those costs. Specifically, on June 26, 2002, the Court entered a "Partial Consent Decree (relating to the Neighborhood Areas)," which resolved the liability of all Settling Defendants other than Jones to the United States and DTSC for response costs related to the Neighborhood Areas, as defined in that agreement. On the same day, the Court entered a "Partial Consent Decree (relating to the Current Storm Water Pathway)," which resolved the liability of

all Settling Defendants other than Jones to the United States, DTSC, and the California Regional Water Quality Control Board, Los Angeles Region, for response costs relating to the Current Storm Water Pathway, as defined in that agreement.

G. This Partial Consent Decree satisfies claims against the Settling Defendants for certain costs incurred by the United States and DTSC for certain response actions at the Dual Site Groundwater Operable Unit of the Montrose Chemical Corp. and Del Amo Superfund Sites (the "Dual Site") in Los Angeles County, California, together with accrued interest, as set forth herein. This Partial Consent Decree also provides for the performance of response actions by the Settling Defendants for the Chlorobenzene Plume at the Dual Site consistent with the National Contingency Plan, 40 C.F.R. Part 300 ("NCP").

H. In accordance with the NCP and Section 121(f)(1)(F) of CERCLA, 42 U.S.C. § 9621(f)(1)(F), EPA notified DTSC on February 4, 2010, of negotiations with potentially responsible parties ("PRPs") regarding the remedy for the Dual Site. EPA has provided DTSC with an opportunity to participate in such negotiations and be a party to this Partial Consent Decree.

I. In accordance with Section 122(j)(1) of CERCLA, 42 U.S.C. § 9622(j)(1), EPA notified the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and the U.S. Department of the Interior, Fish and Wildlife Service and National Park Service on November 17, 2010, of these negotiations and invited them to participate in the consent decree negotiations.

J. Settling Defendants do not admit any liability to Plaintiffs arising out of the transactions or occurrences alleged in the Complaint, nor do they acknowledge that the release or threatened release of hazardous substances at or from the Dual Site constitutes an imminent and substantial endangerment to the public health or welfare or the environment, nor any damage to natural resources.

K. Pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Montrose Chemical Corp. Superfund Site (the "Site") on the National Priorities List ("NPL"), set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on October 4, 1989, 54 Fed. Reg. 41015. By the same authority, EPA included the Del Amo Superfund Site on the NPL on September 5, 2002. 67 Fed. Reg. 56757.

L. In response to a release or a substantial threat of a release of a hazardous substance(s) at or from the Dual Site, Montrose undertook Remedial Investigation ("RI") activities for the Montrose Chemical Corp. Superfund Site in 1986. In 1998, EPA took over the Montrose investigation and completed a Remedial Investigation Report in May 1998, pursuant to 40 C.F.R. § 300.430; and Shell Oil Company ("Shell") issued a separate Remedial Investigation Report for the adjacent Del Amo Study Area the same month. EPA had already assumed responsibility for the Feasibility Study ("FS") and issued a Feasibility Study Report for the Dual Site Groundwater Operable Unit in May 1998.

M. Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the FS and of the proposed plan for the Dual Site in June 1998, in a major local newspaper of general circulation. EPA provided an opportunity for written and oral comments from the public on the proposed plan. A copy of the transcript of the public meeting is available to the public as part of the administrative record upon which the Director of the Superfund Division, as the delegate of the Regional Administrator of EPA Region IX, based the selection of the response action.

N. The decision by EPA on the remedy to be implemented at the Dual Site is embodied in a final Record of Decision ("ROD"), executed on March 30, 1999, on which the State has given its concurrence. The ROD includes a responsiveness summary to the public comments. Notice of the final plan was published in accordance with Section 117(b) of CERCLA, 42 U.S.C. § 9617(b).

The ROD was modified on October 7, 2019 by a memorandum regarding Clarification of Performance Standards Regarding Hydraulic Extraction and Reinjection in Section 13 of the 1999 Superfund Record of Decision: Montrose Chemical and Del Amo Sites, OU 3 (the "Flowrate Memo"). The modification will not have a significant impact on the scope, performance or cost of the remedy.

O. After issuance of the ROD, remedial design work began. Initially, EPA undertook a groundwater modeling effort to assess the direction and flow of groundwater in and near the Dual Site. In 2003, EPA issued separate Administrative Orders to Montrose and Shell for the Interim Remedial Design. *See* In The Matter of the Montrose Chemical Superfund Site and the Del Amo Superfund Site, Los Angeles, California, Groundwater Operable Unit, U.S. EPA Docket Number 2003-06, and In The Matter of the Del Amo Superfund Site and Montrose Chemical Superfund Site, Los Angeles, California, Groundwater Operable Unit, U.S. EPA Docket Number 2003-08. Montrose and Shell complied with those orders. EPA subsequently issued another order to Montrose and Shell, EPA Administrative Order Number 2008-04A ("EPA Order 2008-04A"), requiring completion of certain elements of remedial design. EPA approved the remedial design report for the Chlorobenzene Plume remedy required under EPA Order 2008-04A in September 2012.

P. On August 22, 2012, the Court entered a partial consent decree (the "Construction CD") under CERCLA in this action relating to the Dual Site. Under the Construction CD, Settling Defendants Montrose Chemical Corporation of California, Bayer CropScience Inc., TFCF America, Inc., and Stauffer Management Company LLC (collectively, the "DDT Parties"), are performing a discrete component of the remedy for the Dual Site selected by EPA in the ROD, namely financing and performing construction of the primary groundwater treatment system for the Chlorobenzene Plume of groundwater contamination, as

described in the ROD for the Dual Site. All elements of construction that are set forth in the statement of work attached to the Construction CD will be undertaken pursuant to the Construction CD, rather than this Partial Consent Decree. The DDT Parties will also pay oversight costs incurred by EPA and DTSC pursuant to the terms of the Construction CD. The DDT Parties receive a covenant not to sue from the United States and DTSC in the Construction CD with respect to their performance of their obligations thereunder, fully effective upon completion of the work required by the Construction CD. The DDT Parties currently estimate that the work required by the Construction CD will be fully implemented before the end of 2021.

Q. On August 4, 1993, EPA issued General Notice to Settling Defendant Jones, providing notice that EPA considers Jones to be a potentially responsible party with respect to contamination found at the Dual Site. EPA issued Special Notice to Settling Defendant Jones on January 20, 2011, inviting Jones to participate in formal negotiations to facilitate implementation of the remedial action for the Dual Site.

R. To facilitate the resolution of this matter and the prompt and early commencement of the remedial action for the Dual Site, EPA, after consultation with the State, has determined that, based on the information currently available, it is appropriate to enter into this Partial Consent Decree, which addresses part of the multi-step remedy selected in the ROD as well as certain response costs incurred by the United States and DTSC. This Partial Consent Decree addresses only the Chlorobenzene Plume and does not address the TCE Plume and Benzene Plume. This Partial Consent Decree is without prejudice to all Parties' rights, claims, and defenses with respect to future response actions related to the TCE Plume and the Benzene Plume. Plaintiffs anticipate that the remedial actions for the TCE Plume and the Benzene Plume, as described in the ROD, will be implemented by other parties under separate enforcement instruments.

S. Based on the information currently available, EPA and DTSC believe that the Work will be properly and promptly conducted by Settling Defendants if conducted in accordance with the requirements of this Partial Consent Decree and its appendices.

T. Solely for the purposes of Section 113(j) of CERCLA, 42 U.S.C. § 9613(j), the remedial action set forth in the ROD and the Work to be performed by Settling Defendants shall constitute a response action taken or ordered by the President for which judicial review shall be limited to the administrative record. In accordance with Section 113(j) of CERCLA, otherwise applicable principles of administrative law shall govern whether any supplemental materials may be considered by the Court.

U. In addition, the Court has already considered certain issues relating to liability for the groundwater contamination emanating from the Site and issued an Order on Summary Judgment (Order Granting United States' Motion for Partial Summary Judgment, April 24, 2000, as amended by Joint Stipulation and Order, July 18, 2000) (ECF Nos. 1922 and 2100). In these Orders, the Court concluded that Montrose, Atkemix Thirty-Seven, Inc. (corporate predecessor of Settling Defendant Stauffer Management Company LLC), and Aventis CropScience USA, Inc. (corporate predecessor of Settling Defendant Bayer CropScience Inc.) are jointly and severally liable for all costs of removal or remedial action incurred by the United States or DTSC with respect to the former Montrose Plant Property and certain property referred to in the orders as the "Stauffer Property" and currently owned by Settling Defendant Stauffer Management Company LLC. The relevant property is the 13-acre parcel located at 20201 Normandie Avenue in Los Angeles County where Montrose manufactured the pesticide dichlorodiphenyl trichloroethane, or DDT, between 1947 and 1982. Montrose and Aventis CropScience USA, Inc. (corporate predecessor of Settling Defendant Bayer CropScience Inc.) were also adjudged

jointly and severally liable for all costs of removal or remedial action incurred by the United States and State of California in responding to releases of hazardous substances to the Palos Verdes Shelf and in the soil and groundwater at and around the Montrose property (ECF No. 2445). These judgments provided declaratory relief pursuant to Section 113(g)(2)(B) of CERCLA, 42 U.S.C. § 9613(g)(2)(B).

V. The Parties recognize, and the Court by entering this Partial Consent Decree finds, that this Partial Consent Decree has been negotiated by the Parties in good faith, that implementation of this Partial Consent Decree will expedite the cleanup of the Chlorobenzene Plume and will avoid further prolonged and complicated litigation between the Parties, and that this Partial Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331 and 1345, and 42 U.S.C. §§ 9606, 9607, and 9613(b). This Court also has personal jurisdiction over Settling Defendants. Solely for the purposes of this Partial Consent Decree and the underlying Complaint, Settling Defendants waive all objections and defenses that they may have to jurisdiction of the Court or to venue in this District. Settling Defendants shall not challenge the terms of this Partial Consent Decree or this Court's jurisdiction to enter and enforce this Partial Consent Decree.

III. PARTIES BOUND

2. This Partial Consent Decree applies to and is binding upon the United States, DTSC, and Settling Defendants and their successors and assigns. Any change in ownership or corporate status of a Settling Defendant including, but not limited to, any transfer of assets or real or personal property, shall in no way alter Settling Defendants' responsibilities under this Partial Consent Decree.

3. Settling Defendants shall provide a copy of this Partial Consent Decree to each contractor hired by Settling Defendants to perform the Work required by this Partial Consent Decree and to each person representing any Settling Defendant with respect to the Chlorobenzene Plume or the Work, and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this Partial Consent Decree. Settling Defendants or their contractors shall provide written notice of this Partial Consent Decree to all subcontractors hired to perform any portion of the Work required by this Partial Consent Decree. Settling Defendants shall nonetheless be responsible for ensuring that their contractors and subcontractors perform the Work in accordance with the terms of this Partial Consent Decree. With regard to the activities undertaken pursuant to this Partial Consent Decree, each contractor and subcontractor shall be deemed to be in a contractual relationship with Settling Defendants within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3).

IV. DEFINITIONS

4. Unless otherwise expressly provided in this Partial Consent Decree, terms used in this Partial Consent Decree that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Partial Consent Decree or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply solely for purposes of this Partial Consent Decree:

"Benzene Plume" shall mean the portion of the distribution of benzene in groundwater at the Dual Site that is not commingled with chlorobenzene, as defined in the ROD (page 7-11).

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C.

§§ 9601 – 9675.

"Chlorobenzene Plume" shall mean the entire distribution of chlorobenzene in groundwater at the Dual Site, and all other contaminants that are commingled with the chlorobenzene, as defined in the ROD (page 7-10).

"Construction CD" shall mean the Partial Consent Decree entered by the Court on August 22, 2012 (ECF No. 2735).

"Construction CD Obligations" shall mean all activities and obligations within the definition of "Work" set forth in Paragraph 4 of the Construction CD and all costs required to be paid under the Construction CD.

"Containment Zone" shall have the same meaning as set forth in the ROD. *See* Section 13 of the ROD.

"Day" shall mean a calendar day unless expressly stated to be a Working Day. The term "Working Day" shall mean a day other than a Saturday, Sunday, or federal or State holiday. In computing any period of time under this Partial Consent Decree, where the last day would fall on a Saturday, Sunday, or federal or State holiday, the period shall run until the close of business of the next Working Day.

"DDT Parties" shall mean Settling Defendants Montrose Chemical Corporation of California, Bayer CropScience Inc., TFCF America, Inc. (formerly 21st Century Fox America, Inc.), and Stauffer Management Company LLC.

"DTSC" shall mean the California Department of Toxic Substances Control, its officers, employees and representatives, all of its divisions and branches, any predecessor agency in interest, and the Hazardous Substance Account, as defined in California Health and Safety Code § 25330.

"DTSC Future Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that DTSC incurs in reviewing or developing plans, reports, and other deliverables submitted pursuant to this

Partial Consent Decree, in overseeing implementation of the Work, or otherwise implementing, overseeing, or enforcing this Partial Consent Decree, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Sections VII (Remedy Review) and XIII (Emergency Response), and attorney fees (including paying for the services of the California Attorney General's Office). DTSC Future Response Costs also shall include all DTSC Interim Response Costs, and all Interest on those DTSC Past Response Costs that remain outstanding more than 60 Days from the date of the bill.

"DTSC Interim Response Costs" shall mean all costs, including direct and indirect costs, (a) paid by DTSC in connection with the Dual Site between October 1, 2019, and the Effective Date, or (b) incurred prior to the Effective Date but paid after that date in connection with the Dual Site. DTSC Interim Response Costs shall not include, however, DTSC costs paid by the DDT Parties under the Construction CD.

"DTSC Past Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that DTSC paid at or in connection with the Dual Site between July 1, 2017, and September 30, 2019, plus Interest on all such costs which has accrued pursuant to 42 U.S.C. § 9607(a) through such date. DTSC Past Response Costs paid under this Partial Consent Decree shall not be costs paid by the DDT Parties under the Construction CD.

"Dual Site" shall mean the Dual Site Groundwater Operable Unit of the Montrose Chemical Corp. and Del Amo Superfund Sites, in Los Angeles County, California, which is depicted generally on the map attached as Appendix C.

"Effective Date" shall be the date upon which this Partial Consent Decree is entered by the Court as recorded on the Court docket, or, if the Court instead issues an order approving this Partial Consent Decree, the date such order

is recorded on the Court docket.

"EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

"EPA Future Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States incurs in reviewing or developing plans, reports, and other deliverables submitted pursuant to this Partial Consent Decree, in overseeing implementation of the Work, or otherwise implementing, overseeing, or enforcing this Partial Consent Decree, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Paragraph 9 (Notice to Successors-in-Title and Transfers of Real Property), Section VII (Remedy Review), Section VIII (Access) (including, but not limited to, the cost of attorney time and any monies paid to secure access including, but not limited to, the amount of just compensation), Section XIII (Emergency Response), Paragraph 36 (Funding for Work Takeover), and Section XXVII (Community Relations). EPA Future Response Costs shall also include all EPA Interim Response Costs, and all Interest on those EPA Past Response Costs Settling Defendants have agreed to pay under this Partial Consent Decree that has accrued pursuant to 42 U.S.C. § 9607(a) during the period from July 31, 2019 to the Effective Date. EPA Future Response Costs shall not include, however, EPA costs payable by the DDT Parties under the Construction CD.

"EPA Interim Response Costs" shall mean all costs, including direct and indirect costs, (a) paid by the United States in connection with the Chlorobenzene Plume between July 31, 2019, and the Effective Date, including costs incurred pursuant to EPA's oversight of EPA Order 2008-04A, or (b) incurred by the United States in connection with the Chlorobenzene Plume prior to the Effective Date but paid after that date. EPA Interim Response Costs shall not include, however, EPA costs payable by the DDT Parties under the

Construction CD, and shall not include costs related to the Dense Nonaqueous Phase Liquid ("DNAPL") Operable Unit of the Site.

"EPA Past Response Costs" shall mean all unrecovered costs, including, but not limited to, direct and indirect costs, that the United States paid at or in connection with the Dual Site between October 1, 1999, and July 31, 2019, including costs related to EPA Order 2008-04A, plus Interest on all such costs which has accrued pursuant to 42 U.S.C. § 9607(a) through such date. EPA Past Response Costs shall not include, however, EPA costs payable by the DDT Parties under the Construction CD, and shall not include costs related to the DNAPL Operable Unit of the Site.

"Flowrate Memo" shall mean the memorandum making non-significant changes to the ROD titled "Clarification of Performance Standards Regarding Hydraulic Extraction and Reinjection in Section 13 of the 1999 Superfund Record of Decision: Montrose Chemical and Del Amo Sites, OU 3," issued on October 7, 2019.

"Institutional Controls" or "ICs" shall mean Proprietary Controls and state or local laws, regulations, ordinances, zoning restrictions, or other governmental controls or notices that: (a) limit land, water, or other resource use to minimize the potential for human exposure to Waste Material at or in connection with the Dual Site; (b) limit land, water, or other resource use to implement, ensure non-interference with, or ensure the protectiveness of the remedial action for the Dual Site as set forth in the ROD; and/or (c) provide information intended to modify or guide human behavior at or in connection with the Dual Site.

"Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in

effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

"MACP" shall mean the monitoring and aquifer compliance plan for implementing, maintaining, monitoring, and reporting of performance monitoring sufficient to meet the objectives of the ROD, as required by Section 3.9 of the SOW.

"Montrose Onshore Special Account" shall mean the special account, within the EPA Hazardous Substance Superfund, established for the Montrose Chemical Corp. Superfund Site by EPA pursuant to Section 122(b)(3) of CERCLA, 42 U.S.C. § 9622(b)(3).

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

"Owner Settling Defendant" shall mean Stauffer Management Company LLC.

"Paragraph" shall mean a portion of this Partial Consent Decree identified by an Arabic numeral or an upper or lower case letter.

"Partial Consent Decree" or "Decree" shall mean this Partial Consent Decree and all appendices attached hereto (listed in Section XXVI, Appendices). In the event of conflict between this Partial Consent Decree and any appendix, this Partial Consent Decree shall control.

"Parties" shall mean the United States, DTSC, and Settling Defendants.

"Performance Standards" shall mean the cleanup standards and other measures of achievement of the goals of the Remedial Action that are related to the Chlorobenzene Plume, set forth in Section 13 of the ROD, as modified by the Flowrate Memo.

"Plaintiffs" shall mean the United States and the State, on behalf of DTSC.

"Post-Achievement O&M" shall mean all activities required to maintain the effectiveness of the Remedial Action after Performance Standards are met, including, but not limited to, activities required to contain the Chlorobenzene Plume within the Containment Zone indefinitely, as set forth in the RA/OM WP approved by EPA, after reasonable opportunity for review and comment by DTSC, pursuant to Section VI (Performance of the Work by Settling Defendants) and the SOW, as provided in the MACP.

"Pre-Achievement O&M" shall mean all operation and maintenance activities required for the Remedial Action to achieve Performance Standards, as provided under the RA/OM WP approved by EPA, after reasonable opportunity for review and comment by DTSC, pursuant to Section VI (Performance of the Work by Settling Defendants) and the SOW, until Performance Standards are met.

"Proprietary Controls" shall mean easements or covenants running with the land that (a) limit land, water, or other resource use and/or provide access rights and (b) are created pursuant to common law or statutory law by an instrument that is recorded in the appropriate land records office.

"Remedial Action/Operation and Maintenance Work Plan" or "RA/OM WP" shall mean the document developed pursuant to Section 3.1 of the SOW and Paragraph 12 below and approved by EPA, and any modifications thereto.

"RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901 – 6992 (also known as the Resource Conservation and Recovery Act).

"Record of Decision" or "ROD" shall mean the EPA Record of Decision relating to the Dual Site Groundwater Operable Unit signed on March

30, 1999, by the Regional Administrator, EPA Region IX, or his/her delegate, and all attachments thereto, as modified by the Flowrate Memo. The ROD and the Flowrate Memo are attached as Appendix A.

"Remaining Work" shall mean, collectively, all activities, excluding the Work and the Construction CD Obligations, that will be necessary to implement the remedy selected in the ROD.

"Remedial Action" shall mean all activities Settling Defendants are required to perform under this Partial Consent Decree to implement the relevant portions of the ROD relating to the Chlorobenzene Plume, in accordance with the SOW, the final approved remedial design submission, the approved RA/OM WP, and other plans approved by EPA, including Pre-Achievement O&M, until the Performance Standards are met, and excluding performance of Post-Achievement O&M and the activities required under Section XXIII (Retention of Records).

"Section" shall mean a portion of this Partial Consent Decree identified by a Roman numeral.

"Settling Defendant," individually, and "Settling Defendants," collectively, shall mean TFCF America, Inc., Bayer CropScience Inc., Montrose Chemical Corporation of California ("Montrose"), Stauffer Management Company LLC and/or JCI Jones Chemicals, Inc. ("Jones").

"SOW" shall mean the statement of work for implementation of the Remedial Action and O&M for the Chlorobenzene Plume, as set forth in Appendix B to this Partial Consent Decree, and any modifications made to it in accordance with this Partial Consent Decree.

"State" shall mean the State of California and each department, agency and instrumentality of the State of California, including DTSC.

"Supervising Contractor" shall mean the principal contractor retained by Settling Defendants to supervise and direct the implementation of the Work under this Partial Consent Decree.

"TCE Plume" shall mean the portion of the distribution of chlorinated solvents – including, but not necessarily limited to, trichloroethene ("TCE"), perchloroethene ("PCE"), dichloroethene ("DCE") and trichloroethane ("TCA"), and any isomers of these compounds, in groundwater at the Dual Site that is not commingled with the Chlorobenzene Plume, as defined in the ROD (page 7-11).

"Transfer" shall mean to sell, assign, convey, lease, mortgage, or grant a security interest in, or where used as a noun, a sale, assignment, conveyance, or other disposition of any interest by operation of law or otherwise.

"United States" shall mean the United States of America and each department, agency and instrumentality of the United States, including EPA.

"Waste Material" shall mean (1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and (4) any hazardous substance under California Health and Safety Code § 25316.

"Work" shall mean all activities and obligations that Settling Defendants are required to perform under this Partial Consent Decree relating to the Chlorobenzene Plume, except the activities required under Section XXIII (Retention of Records).

V. GENERAL PROVISIONS

5. Objectives of the Parties. The objectives of the Parties in entering into this Partial Consent Decree are to protect public health, welfare, and the environment by providing for the implementation of response actions at the Chlorobenzene Plume by Settling Defendants, the payment by Settling Defendants of EPA and DTSC response costs, and the resolution of certain claims (or, in the case of Jones, the satisfaction of certain potential claims) of Plaintiffs against Settling Defendants, as set forth in Sections XIX and XX

("Covenants by Plaintiffs" and "Covenants by Settling Defendants").

6. Commitments by Settling Defendants.

a. Settling Defendants shall finance and perform the Work in accordance with this Partial Consent Decree, the applicable substantive portions of the ROD, the SOW, and all work plans and other plans, standards, specifications, and schedules set forth in this Partial Consent Decree or developed by and/or approved by EPA pursuant to this Partial Consent Decree.

b. The obligations of Settling Defendants to finance and perform the Work, including obligations to pay amounts due under this Partial Consent Decree, are joint and several. In the event of the insolvency of any Settling Defendant or the failure by any Settling Defendant to implement any requirement of this Partial Consent Decree, the remaining Settling Defendants shall complete all such requirements.

c. Settling Defendants shall pay the United States for EPA Past Response Costs, EPA Interim Response Costs and EPA Future Response Costs, and pay DTSC for DTSC Past Response Costs, DTSC Interim Response Costs and DTSC Future Response Costs, as provided in this Partial Consent Decree.

d. Settling Defendants shall finance and perform any periodic review activities required under Section VII of this Partial Consent Decree (Remedy Review) and any additional activities related to the Chlorobenzene Plume required pursuant to Section XII (Certification of Completion) in accordance with this Partial Consent Decree, the applicable provisions of the ROD, the SOW, and all work plans and other plans, standards, specifications, and schedules set forth in this Partial Consent Decree or developed by and approved by EPA, after reasonable opportunity for review and comment by DTSC.

7. Compliance with Applicable Law. All activities undertaken by Settling Defendants pursuant to this Partial Consent Decree shall be performed in accordance with the requirements of all applicable federal and California laws

and regulations. Settling Defendants must also comply with all applicable or relevant and appropriate requirements of all federal and state environmental laws as set forth in the ROD and the SOW. The activities conducted pursuant to this Partial Consent Decree, if approved by EPA, shall be deemed to be consistent with the NCP.

8. Permits.

a. As provided in Section 121(e) of CERCLA, 42 U.S.C. § 9621(e), and Section 300.400(e) of the NCP, no permit shall be required for any portion of the Work conducted entirely on-site (i.e., within the areal extent of contamination or in very close proximity to the contamination and necessary for implementation of the Work). Settling Defendants may seek the assistance of the United States and DTSC with respect to permits proposed by any State, county, municipal, or other governmental body.

b. Where any portion of the Work that is not on-site requires a federal or state permit or approval, Settling Defendants shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. Settling Defendants may seek relief under the provisions of Section XVI (Force Majeure) for any delay in the performance of the Work resulting from a failure to obtain, or a delay in obtaining, any permit or approval referenced in Paragraph 8.a and required for the Work, provided that Settling Defendants have submitted timely and complete applications and taken all other actions necessary to obtain all such permits or approvals.

c. This Partial Consent Decree is not, and shall not be construed to be, a permit issued pursuant to any federal or state statute or regulation.

9. Notice to Successors-in-Title and Transfers of Real Property.

a. For any real property owned or controlled by Owner Settling Defendant located at the Dual Site, Owner Settling Defendant shall, within 15 Days after the Effective Date, submit to EPA for review and approval a proposed

notice to be filed with the appropriate land records office that provides a description of the real property and provides notice to all successors-in-title that the real property is part of the Dual Site, that EPA has selected a remedy for the Dual Site, and that potentially responsible parties have entered into a Partial Consent Decree requiring implementation of the remedy. The notice also shall identify the United States District Court in which this Partial Consent Decree was filed, the name and civil action number of this case, and the date this Partial Consent Decree was entered by the Court. Owner Settling Defendant shall record the notice within ten Days after EPA's approval of the notice. Owner Settling Defendant shall provide EPA with a certified copy of the recorded notice within ten Days after recording such notice.

b. Owner Settling Defendant shall, at least 60 Days prior to any Transfer of any real property located at the Dual Site, give written notice: (1) to the transferee regarding this Partial Consent Decree; and (2) to EPA and DTSC regarding the proposed Transfer, including the name and address of the transferee and the date on which the transferee was notified of this Partial Consent Decree.

c. Owner Settling Defendant may Transfer any real property located at the Dual Site only if: Owner Settling Defendant has obtained an agreement from the transferee, enforceable by Settling Defendants, the State, and the United States, to allow access and restrict land/water use, pursuant to Paragraph 20, and EPA has approved the agreement in writing. If, after a Transfer of the real property, the transferee fails to comply with the agreement provided for in this Paragraph 9.c, Owner Settling Defendant shall take all reasonable steps to obtain the transferee's compliance with such agreement. The United States may seek the transferee's compliance with the agreement and/or assist Owner Settling Defendant in obtaining compliance with the agreement. Settling Defendants shall reimburse the United States under Section XIV (Payments for Response Costs), for all costs incurred, direct or indirect, by the United States regarding

obtaining compliance with such agreement, including, but not limited to, the cost of attorney time.

d. In the event of any Transfer of real property located at the Dual Site, unless the United States otherwise consents in writing, Settling Defendants shall continue to comply with their obligations under this Partial Consent Decree, including, but not limited to, their obligation to provide and/or secure access.

VI. PERFORMANCE OF THE WORK BY SETTLING DEFENDANTS

10. Selection of Supervising Contractor.

a. All aspects of the Work to be performed by Settling Defendants pursuant to Sections VI (Performance of the Work by Settling Defendants), VII (Remedy Review), VIII (Access), and XIII (Emergency Response) shall be under the direction and supervision of the Supervising Contractor, the selection of which shall be subject to disapproval by EPA after a reasonable opportunity for review and comment by DTSC. Within 30 Days after the lodging of this Partial Consent Decree, Settling Defendants shall notify EPA and DTSC in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor for the Work. With respect to any contractor proposed to be Supervising Contractor, Settling Defendants shall demonstrate that the proposed contractor has a quality assurance system that complies with ANSI/ASQC E4-2004, Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use (American National Standard), by submitting a copy of the proposed contractor's Quality Management Plan ("QMP"). The QMP should be prepared in accordance with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001, reissued May 2006) or equivalent documentation as determined by EPA. EPA will issue a notice of disapproval or an authorization to proceed regarding hiring of each proposed contractor. If at any time thereafter, Settling Defendants propose to change the Supervising Contractor, Settling Defendants shall give

notice to EPA and DTSC and must obtain an authorization to proceed from EPA, after a reasonable opportunity for review and comment by DTSC, before the new Supervising Contractor performs, directs, or supervises any Work under this Partial Consent Decree.

b. If EPA disapproves a proposed Supervising Contractor, EPA will notify Settling Defendants in writing. Settling Defendants shall submit to EPA and DTSC a list of contractors, including the qualifications of each contractor, that would be acceptable to them within 30 Days of receipt of EPA's disapproval of the contractor previously proposed. EPA will provide written notice of the names of any contractor(s) that it disapproves and an authorization to proceed with respect to any of the other contractors. Settling Defendants may select any contractor from that list that is not disapproved and shall notify EPA and DTSC of the name of the contractor selected within 21 Days of EPA's authorization to proceed.

c. If EPA fails to provide written notice of its authorization to proceed or disapproval as provided in this Paragraph and this failure prevents Settling Defendants from meeting one or more deadlines in a plan approved by EPA pursuant to this Partial Consent Decree, Settling Defendants may seek relief under Section XVI (Force Majeure).

11. <u>Remedial Design</u>.

a. The Parties acknowledge that Montrose has completed the remedial design report for the Chlorobenzene Plume remedy, pursuant to EPA Order 2008-04A.

b. Montrose did not undertake design of systems to address the TCE Plume or the Benzene Plume, which are elements of the remedy selected in the ROD. Design of the TCE Plume and Benzene Plume remedy is outside the scope of this Partial Consent Decree.

12. <u>Remedial Action</u>.

a. Within 30 Days after the Effective Date, Settling Defendants shall submit to EPA and DTSC an RA/OM WP for performance of the Remedial Action at the Chlorobenzene Plume. Remedial Action for the TCE Plume and Benzene Plume is outside the scope of this Partial Consent Decree. The RA/OM WP shall provide for implementation of the SOW and achievement of the Performance Standards, in accordance with this Partial Consent Decree, the relevant portions of the ROD, the SOW, and the final approved remedial design submission. Upon approval by EPA, after reasonable opportunity for review and comment by DTSC, the RA/OM WP shall be incorporated into and enforceable under this Partial Consent Decree.

b. Periodic monitoring for the Chlorobenzene Plume remedy shall be conducted as part of this remedy in accordance with the EPA-approved MACP, approved by EPA after reasonable opportunity for review and comment by DTSC.

c. In this and every other respect, Settling Defendants shall fully implement and comply with the SOW that is attached hereto as Appendix B and incorporated herein by reference. The Work to be performed pursuant to this Partial Consent Decree shall, at a minimum, achieve the requirements of, and be performed in a manner consistent with, the applicable portions of the ROD and this Partial Consent Decree.

13. Settling Defendants shall continue to implement the Remedial Action until the Performance Standards are achieved. Settling Defendants shall implement Post-Achievement O&M for so long thereafter as is required by this Partial Consent Decree.

14. <u>Modification of SOW or Related Work Plans</u>.

a. If EPA, following consultation with DTSC, determines that it is necessary to modify the work specified in the SOW and/or in work plans developed pursuant to the SOW to achieve and maintain the Performance

Standards or to carry out and maintain the effectiveness of the remedy set forth in the relevant portions of the ROD, and such modification is consistent with the scope of the remedial work set forth in the ROD, then EPA may issue such modification in writing and shall notify Settling Defendants of such modification. For the purposes of this Paragraph and Paragraphs 38 (Completion of the Remedial Action) and 39 (Completion of the Work) only, the "scope of the remedial work set forth in the ROD" is generally composed of the following elements for the Chlorobenzene Plume, as further specified in the ROD:

(1) Where technically practicable, reduce the concentrations of contaminants in groundwater for the Chlorobenzene Plume to in-situ groundwater standards levels, as described in the ROD, Section 13, part 9;

(2) In areas of groundwater where attainment of in-situ groundwater standards levels is not technically practicable, contain contaminants within their lateral extent and depth, as described in the ROD, Section 10.4 and Section 13, parts 5 and 8;

(3) Isolate chlorobenzene non-aqueous phase liquid ("NAPL") by surrounding it with a zone of groundwater from which dissolved phase contaminants cannot escape, as described in the ROD, Section 13, parts 5 and 8;

(4) Prevent lateral and vertical migration of dissolved contaminants in groundwater at concentrations greater than in-situ groundwater standards to areas where currently they are not present or are below in-situ groundwater standards, as described in the ROD, Section 13, part 10; and

(5) Protect current and future users of groundwater from exposure to Chlorobenzene Plume groundwater contaminants at concentrations above in-situ groundwater standards levels.

The "scope of the remedial work set forth in the ROD" shall not include treatment of para-chlorobenzene sulfonic acid ("pCBSA") below the 25,000 parts per billion ("ppb") reinjection standard set forth in the ROD or discharge of treated water by means other than aquifer reinjection. If Settling Defendants object to the modification they may, within 45 Days after EPA's notification, seek dispute resolution under Paragraph 59 (Record Review).

b. The SOW and/or related work plans shall be modified: (i) in accordance with the modification issued by EPA; or (ii) if Settling Defendants invoke dispute resolution, in accordance with the final resolution of the dispute. The modification shall be incorporated into and enforceable under this Partial Consent Decree. Settling Defendants shall incorporate the modification into its RA/OM WP under Paragraph 12, as appropriate, and shall implement all work required by such modification.

c. Nothing in this Paragraph shall be construed to limit EPA's authority to require performance of further response actions as provided in other paragraphs of this Partial Consent Decree, including, but not limited to, Paragraph 17.

15. Nothing in this Partial Consent Decree, the SOW, EPA Order 2008-04A, the final approved remedial design submission, or the RA/OM WP constitutes a warranty or representation of any kind by Plaintiffs that compliance with the work requirements set forth in the SOW and the RA/OM WP will ensure completion of the Work in compliance with the applicable substantive portions of the ROD.

VII. REMEDY REVIEW

16. <u>Periodic Review</u>. Settling Defendants shall conduct any studies and investigations that EPA requests in order to permit EPA to conduct reviews of whether the Remedial Action is protective of human health and the environment at least every five years as required by Section 121(c) of CERCLA, 42 U.S.C.

§ 9621(c), and any applicable regulations.

17. EPA Selection of Further Response Actions. If EPA determines at any time that the Remedial Action is not protective of human health and the environment, EPA may, after a reasonable opportunity for review and comment by DTSC, select further response actions for the Dual Site in accordance with the requirements of CERCLA and the NCP.

18. Opportunity to Comment. DTSC, Settling Defendants, and, if required by Sections 113(k)(2) or 117 of CERCLA, 42 U.S.C. §§ 9613(k)(2) or 9617, the public, will be provided with an opportunity to comment on any further response actions proposed by EPA as a result of the review conducted pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and to submit written comments for the record during the comment period.

VIII. ACCESS

19. If any real property where access or land/water use restrictions are needed to implement the Work or the Remaining Work is owned or controlled by any of Settling Defendants:

a. Such Settling Defendants shall, commencing on the date of lodging of this Partial Consent Decree, provide the United States, the State, DTSC, and the other Settling Defendants, and their representatives, contractors, and subcontractors, with access at all reasonable times to the Dual Site, or such other real property, for the purpose of conducting any activity related to the Work or Remaining Work including, but not limited to, the following activities:

(1) Monitoring the Work or Remaining Work;

(2) Verifying any data or information submitted to the United States or DTSC;

(3) Conducting investigations regarding contamination at or near the Dual Site;

(4) Obtaining samples;

(5) Assessing the need for, planning, or implementing the Work or Remaining Work or additional response actions at or near the Dual Site;

(6) Assessing implementation of quality assurance and quality control practices as defined in the approved Quality Assurance Project Plans;

(7) Implementing the Work pursuant to the conditions set forth in Paragraph 77 (Work Takeover);

(8) Inspecting and copying non-privileged records, operating logs, contracts, or other documents maintained or generated by Settling Defendants or their agents, consistent with Section XXII (Access to Information);

(9) Assessing Settling Defendants' compliance with this Partial Consent Decree or any other orders or consent decrees that implement the remedy described in the relevant provisions of the ROD; and

(10) Determining whether the Dual Site or other real property is being used in a manner that may need to be prohibited or restricted under this Partial Consent Decree.

b. Commencing on the date of lodging of this Partial Consent Decree, such Settling Defendants shall not use the Dual Site, or such other real property, in any manner that EPA, after a reasonable opportunity for review and comment by DTSC, determines will pose an unacceptable risk to human health or to the environment due to exposure to Waste Materials or interfere with or adversely affect the implementation, integrity, or protectiveness of the Remedial Action. The restrictions shall include, but not be limited to, the following: prohibiting the use of groundwater in the Containment Zone as a drinking water source and limiting the drilling of new groundwater wells or any other excavation

with the potential to penetrate contaminated aquifers.

20. If any real property where access is needed to implement the requirements of the relevant provisions of the ROD or this Partial Consent Decree, is owned or controlled by persons other than any Settling Defendant, Settling Defendants shall use best efforts to secure from such persons an agreement to provide access thereto for the United States, the State, DTSC, and Settling Defendants, and their representatives, contractors and subcontractors, to conduct any activity related to its Work for the Dual Site including, but not limited to, the activities listed in Paragraph 19.a.

21. For purposes of Paragraph 20, "best efforts" includes the payment of reasonable sums of money to obtain access, except that "best efforts" shall not include payment of money to any party that received from EPA a letter providing special notice of potential liability related to the Montrose Chemical Corp. Superfund Site, the Del Amo Superfund Site, or the Dual Site. If, within 120 Days of the Effective Date, Settling Defendants have not obtained agreements to provide access, as required by Paragraph 20, Settling Defendants shall promptly notify the United States and DTSC in writing, and shall include in that notification a summary of the steps that they have taken to attempt to comply with Paragraph 20. The United States and DTSC may, in the manner they deem appropriate, assist Settling Defendants in obtaining access. Settling Defendants shall reimburse the United States and DTSC under Section XIV (Payments for Response Costs), for all costs incurred, direct or indirect, by the United States and DTSC in obtaining such access, including, but not limited to, the cost of attorney time and the amount of monetary consideration paid or just compensation.

22. If EPA, in consultation with DTSC, determines that Institutional Controls in the form of state or local laws, regulations, ordinances, zoning restrictions, or other governmental controls are needed, Settling Defendants shall

cooperate with EPA's and DTSC's efforts to secure and ensure compliance with such Institutional Controls.

23. Notwithstanding any provision of this Partial Consent Decree, the United States and DTSC retain all of their access authorities and rights, as well as all of their rights to require Institutional Controls, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable federal or California statute or regulations.

IX. EPA APPROVAL OF PLANS, REPORTS, AND OTHER DELIVERABLES

24. Initial Submissions.

a. After review of any plan, report, or other deliverable that is required to be submitted for approval pursuant to this Partial Consent Decree, EPA, after reasonable opportunity for review and comment by DTSC, shall: (i) approve, in whole or in part, the submission; (ii) approve the submission upon specified conditions; (iii) disapprove, in whole or in part, the submission; or (iv) any combination of the foregoing.

b. EPA also may modify the initial submission to cure deficiencies in the submission if: (i) EPA determines that disapproving the submission and awaiting a resubmission would cause substantial disruption to the Work; or (ii) previous submission(s) have been disapproved due to material defects and the deficiencies in the initial submission under consideration indicate a bad faith lack of effort to submit an acceptable plan, report, or deliverable.

25. Resubmissions. Upon receipt of a notice of disapproval under Paragraph 24.a.(iii) or (iv), or if required by a notice of approval upon specified conditions under Paragraph 24.a.(ii), Settling Defendants shall, within 21 Days or such longer time as specified by EPA in such notice, correct the deficiencies and resubmit the plan, report, or other deliverable for approval. After review of the resubmitted plan, report, or other deliverable, EPA may, after reasonable

opportunity for review and comment by DTSC: (a) approve, in whole or in part, the resubmission; (b) approve the resubmission upon specified conditions; (c) modify the resubmission; (d) disapprove, in whole or in part, the resubmission, requiring Settling Defendants to correct the deficiencies; or (e) any combination of the foregoing.

26. Material Defects. If an initially submitted or resubmitted plan, report, or other deliverable contains a material defect, and the plan, report, or other deliverable is disapproved or modified by EPA under Paragraph 24.b.(ii) or 25 due to such material defect, then the material defect shall constitute a lack of compliance for purposes of Paragraph 62. The provisions of Section XVII (Dispute Resolution) and Section XVIII (Stipulated Penalties) shall govern the accrual and payment of any stipulated penalties regarding Settling Defendants' submissions under this Section.

27. Implementation. Upon approval, approval upon conditions, or modification by EPA under Paragraph 24 or 25, of any plan, report, or other deliverable, or any portion thereof: (a) such plan, report, or other deliverable, or portion thereof, shall be incorporated into and enforceable under this Partial Consent Decree; and (b) Settling Defendants shall take any action required by such plan, report, or other deliverable, or portion thereof, subject only to their right to invoke the Dispute Resolution procedures set forth in Section XVII (Dispute Resolution) with respect to the modifications or conditions made by EPA. The implementation of any non-deficient portion of a plan, report, or other deliverable submitted or resubmitted under Paragraph 24 or 25 shall not relieve Settling Defendants of any liability for stipulated penalties under Section XVIII (Stipulated Penalties).

28. Review by DTSC. All plans, reports or other deliverables required to be submitted to, or reviewed by, DTSC pursuant to this Partial Consent Decree shall be sent to DTSC separately and simultaneously at the addresses provided in

Section XXIV (Notices and Submissions) of this Partial Consent Decree.

X. PROJECT COORDINATORS

29. Within 30 Days of lodging this Partial Consent Decree, DTSC, EPA, and Settling Defendants will notify all other Parties, in writing, of the name, address, and telephone number of their designated Project Coordinator and Alternate Project Coordinator. If a Project Coordinator or Alternate Project Coordinator initially designated is changed, the identity of the successor will be given to the other Parties at least five Working Days before the change occurs, unless impracticable, but in no event later than the actual day the change is made. Settling Defendants' Project Coordinator shall be subject to disapproval by EPA, after reasonable opportunity for review and comment by DTSC, and shall have the technical expertise sufficient to adequately oversee all aspects of the Work. Project Coordinators shall not be an attorney for any Settling Defendant in this matter. A Project Coordinator may assign another individual, including another contractor, to serve as Settling Defendants' representative for oversight of performance of daily operations during remedial activities.

30. Plaintiffs may designate other representatives, including, but not limited to, EPA and State employees, and federal and State contractors and consultants, to observe and monitor the progress of any activity undertaken pursuant to this Partial Consent Decree. EPA's Project Coordinator and Alternate Project Coordinator shall have the authority lawfully vested in a Remedial Project Manager ("RPM") and an On-Scene Coordinator ("OSC") by the NCP, 40 C.F.R. Part 300. EPA's Project Coordinator or Alternate Project Coordinator shall have authority, consistent with the NCP, to halt any Work required by this Partial Consent Decree and to take any necessary response action when he or she determines that conditions at the Dual Site constitute an emergency situation or may present an immediate threat to public health or welfare or the environment due to release or threatened release of Waste

Material.

31. Settling Defendants' Project Coordinator will meet with EPA's and DTSC's Project Coordinators on a monthly basis, either in person or by teleconference, as established by EPA's Project Coordinator. One year following the Effective Date, the meetings will take place quarterly, unless EPA determines that monthly meetings are still required. Three years after the Effective Date, the meetings will take place semi-annually, unless EPA determines that more frequent meetings are necessary.

XI. PERFORMANCE GUARANTEE

32. In order to ensure the full and final completion of the Work, Settling Defendants shall establish and maintain a performance guarantee for the benefit of EPA, initially in the amount of $52,600,000 (the "Estimated Cost of the Work"). The performance guarantee, which must be satisfactory in form and substance to EPA, shall be in the form of one or more of the following mechanisms (provided that, if Settling Defendants intend to use multiple mechanisms, such multiple mechanisms shall be limited to surety bonds guaranteeing payment, letters of credit, trust funds, and insurance policies):

a. A surety bond unconditionally guaranteeing payment and/or performance of the Work that is issued by a surety company among those listed as acceptable sureties on federal bonds as set forth in Circular 570 of the U.S. Department of the Treasury;

b. One or more irrevocable letters of credit, payable to or at the direction of EPA, that is issued by one or more financial institution(s) (i) that has the authority to issue letters of credit and (ii) whose letter-of-credit operations are regulated and examined by a federal or state agency;

c. A trust fund established for the benefit of EPA that is administered by a trustee (i) that has the authority to act as a trustee and (ii) whose trust operations are regulated and examined by a federal or state agency;

d. A policy of insurance that (i) provides EPA with acceptable rights as a beneficiary thereof; and (ii) is issued by an insurance carrier (a) that has the authority to issue insurance policies in the applicable jurisdiction(s) and (b) whose insurance operations are regulated and examined by a federal or state agency;

e. A demonstration by one or more Settling Defendants that such Settling Defendant(s) meet(s) the financial test criteria of 40 C.F.R. § 264.143(f) with respect to the Estimated Cost of the Work (plus the amount(s) of any other federal or any state environmental obligations financially assured through the use of a financial test or guarantee), provided that all other requirements of 40 C.F.R. § 264.143(f) are met to EPA's satisfaction; or

f. A written guarantee to fund or perform the Work executed in favor of EPA by one or more of the following: (i) a direct or indirect parent company of a Settling Defendant, or (ii) a company that has a "substantial business relationship" (as defined in 40 C.F.R. § 264.141(h)) with at least one Settling Defendant; provided, however, that any company providing such a guarantee must demonstrate to the satisfaction of EPA that it satisfies the financial test and reporting requirements for owners and operators set forth in subparagraphs (1) through (8) of 40 C.F.R. § 264.143(f) with respect to the Estimated Cost of the particular Work (plus the amount(s) of any other federal or any state environmental obligations financially assured through the use of a financial test or guarantee) that it proposes to guarantee hereunder.

33. Settling Defendants have selected, and EPA has found satisfactory, as an initial performance guarantee, two letters of credit, each in the amount of $26,300,000 for a total of $52,600,000. The substance of those letters of credit is set forth as Appendix D. Within 30 Days of the Effective Date, Settling Defendants shall submit copies of all executed and/or otherwise finalized instruments or other documents required in order to make the selected

performance guarantee(s) legally binding to the EPA Regional Financial Management Officer in accordance with Section XXIV (Notices and Submissions), with a copy to Financial Analyst, 75 Hawthorne Street, San Francisco, California 94105, and to the United States and EPA and DTSC as specified in Section XXIV (Notices and Submissions).

34. If, at any time after the Effective Date and before issuance of the Certification of Completion of the Work pursuant to Paragraph 39, Settling Defendants provide a performance guarantee for completion of the Work by means of a demonstration or guarantee pursuant to Paragraph 32.e or 32.f, Settling Defendants shall also comply with the other relevant requirements of 40 C.F.R. § 264.143(f) relating to these mechanisms unless otherwise provided in this Partial Consent Decree, including but not limited to: (a) the initial submission of required financial reports and statements from the relevant entity's chief financial officer ("CFO") and independent certified public accountant ("CPA"), in the form prescribed by EPA in its financial test sample CFO letters and CPA reports available under the "Financial Assurance – Settlements" subject list category on the Cleanup Enforcement Model Language and Sample Documents Database at https://cfpub.epa.gov/compliance/models; (b) the annual re-submission of such reports and statements within 90 Days after the close of each such entity's fiscal year; and (c) the prompt notification of EPA after each such entity determines that it no longer satisfies the financial test requirements set forth at 40 C.F.R. § 264.143(f)(1) and in any event within 90 Days after the close of any fiscal year in which such entity no longer satisfies such financial test requirements. For purposes of the performance guarantee mechanisms specified in this Section XI, references in 40 C.F.R. Part 264, Subpart H, to "closure," "post-closure," and "plugging and abandonment" shall be deemed to include the Work; the terms "current closure cost estimate," "current post-closure cost estimate," and "current plugging and abandonment cost estimate" shall be

deemed to include the Estimated Cost of the Work; the terms “owner” and “operator” shall be deemed to refer to Settling Defendants making a demonstration under Paragraph 32.e; and the terms “facility” and “hazardous waste facility” shall be deemed to include those facilities or components of the Dual Site located within the area addressed by the Work.

35. In the event that EPA determines at any time that a performance guarantee provided by any Settling Defendant pursuant to this Section is inadequate or otherwise no longer satisfies the requirements set forth in this Section, whether due to an increase in the estimated cost of completing the Work or for any other reason, or in the event that any Settling Defendant becomes aware of information indicating that a performance guarantee provided pursuant to this Section is inadequate or otherwise no longer satisfies the requirements set forth in this Section, whether due to an increase in the estimated cost of completing the Work or for any other reason, Settling Defendants, within 30 Days of receipt of notice of EPA’s determination or, as the case may be, within 30 Days of any Settling Defendant becoming aware of such information, shall obtain and present to EPA for approval a proposal for a revised or alternative form of performance guarantee listed in Paragraph 32 that satisfies all requirements set forth in this Section XI; provided, however, that if any Settling Defendant cannot obtain such revised or alternative form of performance guarantee within such 30-Day period, and provided further that the Settling Defendant shall have commenced to obtain such revised or alternative form of performance guarantee within such 30-Day period, and thereafter diligently proceeds to obtain the same, EPA shall extend such period for such time as is reasonably necessary for Settling Defendants in the exercise of due diligence to obtain such revised or alternative form of performance guarantee, such additional period not to exceed 30 Days. In seeking approval for a revised or alternative form of performance guarantee, Settling Defendants shall follow the procedures

set forth in Paragraph 37. Settling Defendants' inability to post a performance guarantee for completion of the Work shall in no way excuse performance of any other requirements of this Partial Consent Decree, including, without limitation, the obligation of Settling Defendants to complete the Work in strict accordance with the terms of this Partial Consent Decree.

36. Funding for Work Takeover. The commencement of Work Takeover for any particular Work pursuant to Paragraph 77 shall trigger EPA's right to receive the benefit of any performance guarantee(s) provided pursuant to Paragraphs 32.a, 32.b, 32.c, 32.d, or 32.f, and at such time EPA shall have immediate access to resources guaranteed under any such performance guarantee(s), whether in cash or in kind, as needed to continue and complete the Work assumed by EPA under the Work Takeover. Upon the commencement of any Work Takeover, if (a) for any reason EPA is unable to promptly secure the resources guaranteed under any such performance guarantee(s), whether in cash or in kind, necessary to continue and complete the Work assumed by EPA under the Work Takeover, or (b) in the event that the performance guarantee involves a demonstration of satisfaction of the financial test criteria pursuant to Paragraph 32.e or Paragraph 32.f(ii), Settling Defendants (or in the case of Paragraph 32.f.(ii), the guarantor) shall immediately upon written demand from EPA deposit into a special account within the EPA Hazardous Substance Superfund or such other account as EPA may specify, in immediately available funds and without setoff, counterclaim, or condition of any kind, a cash amount up to but not exceeding the estimated cost of completing the Work as of such date, as determined by EPA. In addition, if at any time EPA is notified by the issuer of a performance guarantee that such issuer intends to cancel the performance guarantee mechanism it has issued, then, unless Settling Defendants provide a substitute performance guarantee mechanism in accordance with this Section XI no later than 30 Days prior to the impending cancellation date, EPA

shall be entitled (as of and after the date that is 30 Days prior to the impending cancellation) to draw fully on the funds guaranteed under the then-existing performance guarantee. All EPA Work Takeover costs not reimbursed under this Paragraph shall be reimbursed under Section XIV (Payments for Response Costs).

37. Modification of Amount and/or Form of Performance Guarantee.

a. Reduction of Amount of Performance Guarantee. If Settling Defendants believe that the estimated cost of completing the Work has diminished below the amount set forth in Paragraph 32, Settling Defendants may, on any anniversary of the Effective Date, or at any other time agreed to by EPA, DTSC and Settling Defendants, petition EPA in writing to request a reduction in the amount of the performance guarantee provided pursuant to this Section so that the amount of the performance guarantee is equal to the estimated cost of completing the relevant Work. Settling Defendants shall submit a written proposal for such reduction to EPA that shall specify, at a minimum, the estimated cost of completing its Work and the basis upon which such cost was calculated. In seeking approval for a reduction in the amount of the performance guarantee, Settling Defendants shall follow the procedures set forth in Paragraph 37.b(2) for requesting a revised or alternative form of performance guarantee, except as specifically provided in this Paragraph. If EPA decides to accept any such proposal for a reduction in the amount of the performance guarantee, either to the amount set forth in a written proposal or to some other amount as selected by EPA, EPA will notify Settling Defendants of such decision in writing. Upon EPA's acceptance of a reduction in the amount of the performance guarantee, the Estimated Cost of the Work shall be deemed to be the estimated cost of completing the Work set forth in EPA's written decision. After receiving EPA's written decision, Settling Defendants may reduce the amount of the performance guarantee in accordance with and to the extent permitted by such

written acceptance and shall submit copies of all executed and/or otherwise finalized instruments or other documents required in order to make the selected performance guarantee(s) legally binding in accordance with Paragraph 37.b(2). In the event of a dispute, Settling Defendants may reduce the amount of the performance guarantee required hereunder only in accordance with a final administrative or judicial decision resolving such dispute pursuant to Section XVII (Dispute Resolution). No change to the form or terms of any performance guarantee provided under this Section, other than a reduction in amount, is authorized except as provided in Paragraphs 35 or 37.b.

b. Change of Form of Performance Guarantee.

(1) If, after the Effective Date, Settling Defendants desire to change the form or terms of any performance guarantee(s) provided pursuant to this Section, Settling Defendants may, on any anniversary of the Effective Date, or at any other time agreed to by the Parties, petition EPA in writing to request a change in the form or terms of the performance guarantee provided hereunder. The submission of such proposed revised or alternative performance guarantee shall be as provided in Paragraph 37.b(2). Any decision made by EPA on a petition submitted under this Paragraph shall be made in EPA's sole and unreviewable discretion, and such decision shall not be subject to challenge by Settling Defendants pursuant to the dispute resolution provisions of this Partial Consent Decree or in any other forum.

(2) Settling Defendants shall submit a written proposal for a revised or alternative performance guarantee to EPA that shall specify, at a minimum, the estimated cost of completing the Work, the basis upon which such cost was calculated, and the proposed revised performance guarantee, including all proposed instruments or other documents required in order to make the proposed performance guarantee legally binding. The

proposed revised or alternative performance guarantee must satisfy all requirements set forth or incorporated by reference in this Section. Settling Defendants shall submit such proposed revised or alternative performance guarantee to the EPA Regional Financial Management Officer in accordance with Section XXIV (Notices and Submissions), with a copy to Financial Analyst, 75 Hawthorne Street, San Francisco, California 94105. EPA will notify Settling Defendants in writing of its decision to accept or reject a revised or alternative performance guarantee submitted pursuant to this Paragraph. Within ten Working Days after receiving a written decision approving the proposed revised or alternative performance guarantee, Settling Defendants shall execute and/or otherwise finalize all instruments or other documents required in order to make the selected performance guarantee(s) legally binding in a form substantially identical to the documents submitted to EPA as part of the proposal, and such performance guarantee(s) shall thereupon be fully effective. Settling Defendants shall submit copies of all executed and/or otherwise finalized instruments or other documents required in order to make the selected performance guarantee(s) legally binding to the EPA Regional Financial Management Officer within 30 Days of receiving a written decision approving the proposed revised or alternative performance guarantee in accordance with Section XXIV (Notices and Submissions), with a copy to Financial Analyst, 75 Hawthorne Street, San Francisco, California 94105, and to the United States, EPA, and DTSC as specified in Section XXIV.

c. Release of Performance Guarantee. Settling Defendants shall not release, cancel, or discontinue any performance guarantee provided pursuant to this Section except as provided in this Paragraph. If Settling Defendants receive written notice from EPA in accordance with Paragraph 39 that the Work has been fully and finally completed in accordance with the terms of this Partial Consent

Decree, or if EPA otherwise so notifies Settling Defendants in writing, Settling Defendants may thereafter release, cancel, or discontinue the performance guarantee(s) provided pursuant to this Section. In the event of a dispute Settling Defendants may release, cancel, or discontinue the performance guarantee(s) required hereunder only in accordance with a final administrative or judicial decision resolving such dispute pursuant to Section XVII (Dispute Resolution).

XII. CERTIFICATION OF COMPLETION

38. Completion of the Remedial Action.

a. Within 90 Days after Settling Defendants conclude that the Remedial Action has been fully performed and the Performance Standards have been achieved, Settling Defendants shall schedule and conduct a pre-certification inspection to be attended by Settling Defendants, EPA, and DTSC. If, after the pre-certification inspection, Settling Defendants still believe that the Remedial Action has been fully performed and the Performance Standards have been achieved, they shall submit a written report requesting certification to EPA for approval, with a copy to DTSC pursuant to Section IX (EPA Approval of Plans, Reports, and Other Deliverables) within 30 Days after the inspection. In the report, a professional engineer registered in California and Settling Defendants' Project Coordinator shall state that the Remedial Action has been completed in full satisfaction of the requirements of this Partial Consent Decree. The written report shall include as-built drawings signed and stamped by a professional engineer registered in California. The report shall be prepared in accordance with Chapter 2 (Remedial Action Completion) of EPA's *Close Out Procedures for NPL Sites* guidance (May 2011), as supplemented by *Guidance for Management of Superfund Remedies in Post Construction*, OLEM 9200.3-105 (Feb. 2017), and any amendments to the guidance. The report shall include a detailed and comprehensive Performance Evaluation and Status Report, including the elements in Section 3.6 of the SOW, and containing monitoring data to

demonstrate that Performance Standards have been achieved. The report shall contain the following statement, signed by a responsible corporate official of a Settling Defendant or Settling Defendants' Project Coordinator:

> I certify under penalty of federal and State law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If, after completion of the pre-certification inspection and receipt and review of the written report, EPA, after reasonable opportunity for review and comment by DTSC, determines that the Remedial Action or any portion thereof has not been completed in accordance with this Partial Consent Decree or that the Performance Standards have not been achieved, EPA will notify Settling Defendants in writing of the activities that must be undertaken by Settling Defendants pursuant to this Partial Consent Decree to complete the Remedial Action and achieve the Performance Standards, provided, however, that EPA may only require Settling Defendants to perform such activities pursuant to this Paragraph to the extent that such activities are consistent with the "scope of the remedial work set forth in the ROD," as that term is defined in Paragraph 14.a. EPA will set forth in the notice a schedule for performance of such activities consistent with this Partial Consent Decree and the SOW or require Settling Defendants to submit a schedule to EPA for approval pursuant to Section IX (EPA Approval of Plans, Reports, and Other Deliverables). Settling Defendants

shall perform all activities described in the notice in accordance with the specifications and schedules established pursuant to this Paragraph, subject to their right to invoke the dispute resolution procedures set forth in Section XVII (Dispute Resolution).

b. If EPA concludes, based on the initial or any subsequent report requesting Certification of Completion of the Remedial Action and after a reasonable opportunity for review and comment by DTSC, that the Remedial Action has been performed in accordance with this Partial Consent Decree and that the Performance Standards have been achieved, EPA will so certify in writing to Settling Defendants. This certification shall constitute the Certification of Completion of the Remedial Action for purposes of this Partial Consent Decree. Certification of Completion of the Remedial Action shall not affect Settling Defendants' remaining obligations under this Partial Consent Decree.

39. Completion of the Work.

a. Within 90 Days after Settling Defendants conclude that all the Work, other than any periodic review activities required under Section VII (Remedy Review), has been fully performed and the Performance Standards have been achieved, Settling Defendants shall schedule and conduct a pre-certification inspection to be attended by Settling Defendants, EPA, and DTSC. If, after the pre-certification inspection, Settling Defendants still believe that the Work has been fully performed, Settling Defendants shall submit a written report by a professional engineer registered in California stating that the Work has been completed in full satisfaction of the requirements of this Partial Consent Decree. The report shall contain the following statement, signed by a responsible corporate official of a Settling Defendant or Settling Defendants' Project Coordinator:

> I certify under penalty of federal and State law that this document and all attachments were prepared under my direction or supervision in

accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If, after review of the written report, EPA, after reasonable opportunity for review and comment by DTSC, determines that any portion of the Work has not been completed in accordance with this Partial Consent Decree, EPA will notify Settling Defendants in writing of the activities that must be undertaken by Settling Defendants pursuant to this Partial Consent Decree to complete the Work, provided, however, that EPA may only require Settling Defendants to perform such activities pursuant to this Paragraph to the extent that such activities are consistent with the "scope of the remedial work set forth in the ROD," as that term is defined in Paragraph 14.a. EPA will set forth in the notice a schedule for performance of such activities consistent with this Partial Consent Decree and the SOW or require Settling Defendants to submit a schedule to EPA for approval pursuant to Section IX (EPA Approval of Plans, Reports and Other Deliverables). Settling Defendants shall perform all activities described in the notice in accordance with the specifications and schedules established therein, subject to their right to invoke the dispute resolution procedures set forth in Section XVII (Dispute Resolution).

b. If EPA concludes, based on the initial or any subsequent request for Certification of Completion of the Work by Settling Defendants and after a reasonable opportunity for review and comment by DTSC, that the Work has been performed in accordance with this Partial Consent Decree, EPA will so

notify Settling Defendants in writing.

XIII. EMERGENCY RESPONSE

40. If any action or occurrence during the performance of the Work causes or threatens a release of Waste Material from the Dual Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment, Settling Defendants shall, subject to Paragraph 41, immediately take all appropriate action to prevent, abate, or minimize such release or threat of release, in consultation with EPA's Project Coordinator or other available authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plans, the Contingency Plans, and any other applicable plans or documents developed pursuant to the SOW. Settling Defendants shall also immediately notify the EPA's Project Coordinator, or, if the Project Coordinator is unavailable, EPA's Alternate Project Coordinator. If neither of these persons is available, Settling Defendants shall notify the EPA Emergency Response Unit, Region IX. In the event that Settling Defendants fail to take appropriate response action as required by this Section, and EPA or, as appropriate, DTSC takes such action instead, Settling Defendants shall reimburse EPA and DTSC costs of the response action not inconsistent with the NCP pursuant to Section XIV (Payments for Response Costs).

41. Subject to Section XIX (Covenants by Plaintiffs), nothing in the preceding Paragraph or in this Partial Consent Decree shall be deemed to limit any authority of the United States, or the State, (a) to take all appropriate action to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Dual Site, or (b) to direct or order such action, or seek an order from the Court, to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Dual Site.

XIV. PAYMENTS FOR RESPONSE COSTS

42. Payment by Settling Defendants for EPA Past Response Costs and DTSC Past Response Costs.

a. EPA acknowledges a prepayment of EPA Past Response Costs in the amount of $934,387.36, remitted by Montrose on or about September 23, 2005. The remaining balance of EPA Past Response Costs to be paid by Settling Defendants under this Partial Consent Decree, in the amount of $4,000,000, shall be paid by Settling Defendants as follows. Within 45 Days of the Effective Date, Settling Defendants shall pay the amount of $4,000,000, in a single payment, in accordance with Paragraphs 45.a and 45.c (Payment Instructions).

b. The total amount to be paid by Settling Defendants pursuant to Paragraph 42.a shall be deposited by EPA in the Montrose Onshore Special Account to be retained and used to conduct or finance response actions at or in connection with the Montrose Chemical Corp. and/or Del Amo Superfund Sites, or to be transferred by EPA to the EPA Hazardous Substance Superfund.

c. Within 30 Days of the date of the bill, Settling Defendants shall pay DTSC Past Response Costs in the amount of $177,265.36 by official bank check(s) made payable to the Department of Toxic Substances Control. Settling Defendants shall write "Site Code 401628" on the check. Settling Defendants shall send the bank check(s) to Accounting, Department of Toxic Substances Control, 1001 I Street, 21st Floor, P.O. Box 806, Sacramento, CA 95812-0806.

43. Payments by Settling Defendants for EPA Future Response Costs. Settling Defendants shall pay to EPA all EPA Future Response Costs not inconsistent with the NCP.

a. On a periodic basis, generally once per year, EPA will send Settling Defendants a bill requiring payment and enclosing a standard Regionally-prepared cost summary, which provides a statement of direct and

indirect costs incurred by EPA and its contractors, and a DOJ case cost summary. Settling Defendants shall make all payments within 30 Days of Settling Defendants' receipt of each bill requiring payment, except as otherwise provided in Paragraph 46, in accordance with Paragraphs 45.b and 45.c (Payment Instructions).

b. The total amount to be paid by Settling Defendants pursuant to Paragraph 43.a shall be deposited by EPA in the Montrose Onshore Special Account to be retained and used to conduct or finance response actions at or in connection with the Montrose Chemical Corp. and/or Del Amo Superfund Sites, or to be transferred by EPA to the EPA Hazardous Substance Superfund.

c. Within 45 Days of EPA's Certification of Completion of the Work, as set forth at Section XIII of the Construction CD, all remaining property in the Dual Site Trust Fund established in accordance with the Construction CD, less any final trust administration expenses, will be transferred to EPA to credit against oversight costs incurred by EPA at the Dual Site, including EPA Future Response Costs owed under this Partial Consent Decree, in accordance with Section 16(b) of the Dual Site Trust Fund Agreement.

d. If Settling Defendants so request, EPA and DTSC agree to participate in an oversight kickoff meeting at which EPA, DTSC, and Settling Defendants would discuss performance and oversight expectations. EPA and DTSC further agree to participate in annual discussions of the past year's oversight activities and future work oversight expectations.

44. Payments by Settling Defendants for DTSC Future Response Costs. Settling Defendants shall pay to DTSC all DTSC Future Response Costs not inconsistent with the NCP. On a periodic basis, generally quarterly, DTSC will send Settling Defendants a bill requiring payment that includes an invoice and a summary (by activity), which provides a statement of direct and indirect costs incurred by DTSC and its contractors. Upon request by Montrose to the Site's

Project Manager, DTSC will provide the daily log(s) associated with an invoice related to this Partial Consent Decree. Settling Defendants shall make all payments within 30 Days of Settling Defendants' receipt of each bill requiring payment. Settling Defendants shall make all payments to DTSC required by this Paragraph by sending the bank check(s) to: Accounting, Department of Toxic Substances Control, 1001 I Street, 21st Floor, P.O. Box 806, Sacramento, California 95812-0806.

45. Payment Instructions for Settling Defendants.

a. Instructions for EPA Past Response Costs Payments. All payments required, elsewhere in this Partial Consent Decree, to be made in accordance with this Paragraph shall be made in accordance with instructions provided to Settling Defendants by the Financial Litigation Unit ("FLU") of the United States Attorney's Office for the Central District of California after the Effective Date. The payment instructions provided by the Financial Litigation Unit shall include a Consolidated Debt Collection System ("CDCS") number, which shall be used to identify all payments required to be made in accordance with this Partial Consent Decree. The FLU shall provide the payment instructions to:

Settling Defendants
c/o Montrose Chemical Corporation of California
600 Eriksen Avenue NE, Suite 380
Bainbridge Island, WA 98110
(206) 780-9840
mccc@montrosechemical.com

on behalf of Settling Defendants. Settling Defendants may change the individual to receive payment instructions on their behalf by providing written notice of such change in accordance with Section XXIV (Notices and Submissions).

b. Instructions for EPA Future Response Costs Payments and

Stipulated Penalties. All payments required, elsewhere in this Partial Consent Decree, to be made in accordance with this Paragraph shall be made by Fedwire EFT to:

Federal Reserve Bank of New York
ABA = 021030004
Account = 68010727
SWIFT address = FRNYUS33
33 Liberty Street
New York NY 10045
Field Tag 4200 of the Fedwire message should read as follows:
"D 68010727 Environmental Protection Agency"

When making payments under this Paragraph 45.b, Settling Defendants shall also comply with Paragraph 45.c.

c. Instructions for All Payments to EPA. All payments made under Paragraph 45.a or 45.b shall reference the CDCS Number, EPA Site/Spill ID Number 0926/0936 and DOJ Case Number 90-11-2-933/3. At the time of any payment required to be made in accordance with Paragraphs 43, 45.a, or 45.b, Settling Defendants shall send notice of payment to the United States and to EPA, in accordance with Section XXIV (Notices and Submissions), and to the EPA Cincinnati Finance Office by email at cinwd_acctsreceivable@epa.gov, or by mail at 26 Martin Luther King Drive, Cincinnati, Ohio 45268. Such notice shall also reference the CDCS Number, Site/Spill ID Number, and DOJ Case Number.

46. Settling Defendants may contest any EPA Future Response Costs billed under Paragraph 43 or DTSC Future Response Costs billed under Paragraph 44 if they determine that EPA or DTSC has made a mathematical error or included a cost item that is not within the definition of EPA or DTSC Future Response Costs, or if they believe EPA or DTSC incurred excess costs as a direct result of an EPA or DTSC action that was inconsistent with a specific provision or provisions of the NCP.

a. Such objection shall be made in writing within 45 Days of receipt

of the bill and must be sent to the United States (if the United States' accounting is being disputed) or DTSC (if DTSC's accounting is being disputed) pursuant to Section XXIV (Notices and Submissions). Any such objection shall specifically identify the contested EPA or DTSC Future Response Costs and the basis for objection. In the event of an objection, Settling Defendants shall pay all uncontested EPA or DTSC Future Response Costs to the United States or DTSC within 60 Days of Settling Defendants' receipt of the bill requiring payment.

b. Simultaneously, Settling Defendants shall establish an interest-bearing escrow account in a federally-insured bank duly chartered in the State of California and remit to that escrow account funds equivalent to the amount of the contested EPA or DTSC Future Response Costs. Settling Defendants shall send to the United States and DTSC, as provided in Section XXIV (Notices and Submissions), a copy of the transmittal letter and check paying the uncontested EPA or DTSC Future Response Costs, and a copy of the correspondence that establishes and funds the escrow account, including, but not limited to, information containing the identity of the bank and bank account under which the escrow account is established as well as a bank statement showing the initial balance of the escrow account.

c. Simultaneously with establishment of the escrow account, Settling Defendants shall initiate the Dispute Resolution procedures in Section XVII (Dispute Resolution) (provided, however, that references to "EPA" in such Section shall be read to refer to DTSC for purposes of disputes relating to DTSC Future Response Costs under this Paragraph). If the United States or DTSC prevails in the dispute, Settling Defendants shall pay the sums due (with accrued interest) to the United States or DTSC, as appropriate, within five Days of the resolution of the dispute. If Settling Defendants prevail concerning any aspect of the contested costs, Settling Defendants shall pay that portion of the costs (plus associated accrued interest) for which they did not prevail to the United States or

DTSC, as appropriate, within five Days of the resolution of the dispute. Settling Defendants shall be disbursed any balance of the escrow account.

d. All payments to the United States under this Paragraph shall be made in accordance with Paragraphs 45.b and 45.c (Payment Instructions for Settling Defendants' Payments to EPA). All payments to DTSC under this Paragraph shall be made in accordance with Paragraph 44 (Payments by Settling Defendants for DTSC Future Response Costs). The dispute resolution procedures set forth in this Paragraph in conjunction with the procedures set forth in Section XVII (Dispute Resolution) shall be the exclusive mechanisms for resolving disputes regarding Settling Defendants' obligations to reimburse the United States and DTSC for their Future Response Costs.

47. Interest. In the event that any payment for EPA or DTSC Past Response Costs or for EPA or DTSC Future Response Costs required under this Section is not made by the date required, Settling Defendants shall pay Interest on the unpaid balance. The Interest to be paid on EPA Past Response Costs under this Paragraph shall begin to accrue on the Effective Date. The Interest to be paid on DTSC Past Response Costs outstanding more than 60 Days shall begin to accrue from the date of the bill. The Interest on EPA or DTSC Future Response Costs shall begin to accrue on the date of the bill. The Interest shall accrue through the date of Settling Defendants' payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to Plaintiffs by virtue of Settling Defendants' failure to make timely payments under this Section including, but not limited to, payment of stipulated penalties pursuant to Paragraph 62.

XV. INDEMNIFICATION AND INSURANCE

48. Settling Defendants' Indemnification of the United States and DTSC (Negligent or Wrongful Acts or Omissions).

a. The United States and DTSC do not assume any liability by

entering into this Partial Consent Decree or by virtue of any designation of Settling Defendants as EPA's authorized representatives under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e). Settling Defendants shall indemnify, save and hold harmless the United States, DTSC, and their officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Settling Defendants, and each of their officers, directors, employees, agents, contractors, subcontractors, and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Partial Consent Decree, including, but not limited to, any claims arising from any designation of Settling Defendants as EPA's authorized representatives under Section 104(e) of CERCLA. Further, Settling Defendants agree to pay the United States and the State all costs the United States and the State incur including, but not limited to, attorneys' fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States or the State based on negligent or other wrongful acts or omissions of Settling Defendants, their officers, directors, employees, agents, contractors, subcontractors, and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Partial Consent Decree. Neither the United States nor the State shall be held out as a party to any contract entered into by or on behalf of Settling Defendants in carrying out activities pursuant to this Partial Consent Decree. Neither Settling Defendants nor any such contractor shall be considered an agent of the United States or DTSC.

b. The United States and DTSC shall give Settling Defendants notice of any claim for which the United States or DTSC plans to seek indemnification pursuant to this Paragraph, and shall consult with Settling Defendants prior to settling such claim.

49. <u>Settling Defendants' Indemnification of the United States and DTSC</u>

(Contract, Agreement, or Arrangement).

a. Settling Defendants covenant not to sue and agree not to assert any claims or causes of action against the United States or DTSC for damages or reimbursement or for set-off of any payments made or to be made to the United States or DTSC, arising from or on account of any contract, agreement, or arrangement between any one or more of Settling Defendants and any person for performance of Work on or relating to the Dual Site, including, but not limited to, claims on account of construction delays. In addition, Settling Defendants shall indemnify and hold harmless the United States and DTSC with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between any one or more of Settling Defendants and any person for performance of Work on or relating to the Dual Site, including, but not limited to, claims on account of construction delays.

b. The United States and DTSC shall give Settling Defendants notice of any claim for which the United States or DTSC plans to seek indemnification pursuant to this Paragraph, and shall consult with Settling Defendants prior to settling such claim.

50. If, in the future, a California state agency other than DTSC should assume the state CERCLA lead role for oversight under this Partial Consent Decree, the Settling Defendants' indemnification of DTSC pursuant to Paragraphs 48 and 49 shall apply to that new lead state agency.

51. No later than 15 Days before commencing any on-site Work, Settling Defendants shall secure, and shall maintain until Certification of Completion of the Work, commercial general liability insurance with limits of $2 million, for any one occurrence, and automobile liability insurance with limits of $1 million, combined single limit. These policies shall name the United States and DTSC as additional insureds with respect to all insured liability arising out of the activities performed by or on behalf of Settling Defendants pursuant to this

Partial Consent Decree. In addition, for the duration of this Partial Consent Decree, Settling Defendants shall satisfy, or shall ensure that its contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing Work on behalf of Settling Defendants in furtherance of this Partial Consent Decree. Prior to commencement of Work under this Partial Consent Decree, Settling Defendants shall provide to EPA and DTSC certificates of such insurance and, upon request by the United States or DTSC, a copy of each insurance policy. Settling Defendants shall resubmit such certificates and, upon request by the United States or DTSC, copies of policies each year on the anniversary of the Effective Date. If Settling Defendants demonstrate by evidence satisfactory to EPA and DTSC that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then, with respect to that contractor or subcontractor, Settling Defendants need provide only that portion of the insurance described above that is not maintained by the contractor or subcontractor.

XVI. FORCE MAJEURE

52. "Force majeure," for purposes of this Partial Consent Decree, is defined as any event arising from causes beyond the control of any Settling Defendant, of any entity controlled by Settling Defendants, or of Settling Defendants' contractors, that delays or prevents the performance of any obligation under this Partial Consent Decree despite the Settling Defendants' best efforts to fulfill the obligation. The requirement that Settling Defendants exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (1) as it is occurring and (2) following the potential force majeure such that the delay and any adverse effects of the delay are minimized to the greatest extent possible. "Force majeure" does not include financial inability to

complete the Work or a failure to achieve the Performance Standards.

53. If any event occurs or has occurred that may delay the performance of any obligation under this Partial Consent Decree for which Settling Defendants intend or may intend to assert a claim of force majeure, Settling Defendants shall notify orally EPA's Project Coordinator or, in his or her absence, EPA's Alternate Project Coordinator or, in the event both of EPA's designated representatives are unavailable, the Director of the Superfund and Emergency Management Division, EPA Region IX, within five Days of when Settling Defendants first knew that the event might cause a delay. Within 14 Days thereafter, Settling Defendants shall provide in writing to EPA and DTSC an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Settling Defendants' rationale for attributing such delay to a force majeure; and a statement as to whether, in the opinion of Settling Defendants, such event may cause or contribute to an endangerment to public health or welfare, or the environment. Settling Defendants shall include with any notice all available documentation supporting their claim that the delay was attributable to a force majeure. Settling Defendants shall be deemed to know of any circumstance of which Settling Defendants, any entity controlled by Settling Defendants, or Settling Defendants' contractors knew or should have known. Failure to comply with the above requirements regarding an event shall preclude Settling Defendants from asserting any claim of force majeure regarding that event, provided, however, that if EPA, despite the late notice, is able to assess to its satisfaction whether the event is a force majeure under Paragraph 52 and whether Settling Defendants have exercised their best efforts under Paragraph 52, EPA may, in its unreviewable discretion, excuse in writing Settling Defendants' failure to submit timely notices under this

Paragraph.

54. If EPA agrees that the delay or anticipated delay is attributable to a force majeure, the time for performance of the obligations under this Partial Consent Decree that are affected by the force majeure will be extended by EPA for such time as is necessary to complete those obligations. In that case, EPA will notify Settling Defendants in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure. An extension of the time for performance of the obligations affected by the force majeure shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure, EPA will notify Settling Defendants in writing of its decision.

55. If Settling Defendants elect to invoke the dispute resolution procedures set forth in Section XVII (Dispute Resolution), they shall do so no later than 15 Days after receipt of EPA's notice. In any such proceeding, Settling Defendants shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Settling Defendants complied with the requirements of Paragraphs 52 and 53. If Settling Defendants carry this burden, the delay at issue shall be deemed not to be a violation by Settling Defendants of the affected obligation of this Partial Consent Decree identified to EPA and the Court.

XVII. DISPUTE RESOLUTION

56. Unless otherwise expressly provided for in this Partial Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve all disputes arising under or with respect to this Partial Consent Decree. However, the procedures set forth in this Section shall not

apply to actions by the United States or the State to enforce obligations of any Settling Defendants that have not been disputed in accordance with this Section.

57. Any dispute that arises under or with respect to this Partial Consent Decree shall in the first instance be the subject of informal negotiations between the parties to the dispute. The period for informal negotiations shall not exceed 45 Days from the time the dispute arises, unless it is modified by written agreement of the parties to the dispute. The dispute shall be considered to have arisen when one party sends the other parties a written Notice of Dispute.

58. Statements of Position.

a. In the event that the parties to the dispute cannot resolve a dispute by informal negotiations under the preceding Paragraph, then the position advanced by EPA shall be considered binding unless, within 14 Days after the conclusion of the informal negotiation period, Settling Defendants invoke the formal dispute resolution procedures of this Section by serving on the United States and the State a written Statement of Position on the matter in dispute, including, but not limited to, any factual data, analysis or opinion supporting that position and any supporting documentation relied upon by Settling Defendants. The Statement of Position shall specify Settling Defendants' position as to whether formal dispute resolution should proceed under Paragraph 59 or Paragraph 60.

b. Within 45 Days after receipt of Settling Defendants' Statement of Position, EPA will serve on Settling Defendants its Statement of Position, including, but not limited to, any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by EPA. EPA's Statement of Position shall include a statement as to whether formal dispute resolution should proceed under Paragraph 59 or 60. Within 45 Days after receipt of EPA's Statement of Position, Settling Defendants may submit a reply.

c. If there is disagreement between EPA and Settling Defendants as

to whether dispute resolution should proceed under Paragraph 59 or 60, the parties to the dispute shall follow the procedures set forth in the Paragraph determined by EPA to be applicable. However, if Settling Defendants ultimately appeal to the Court to resolve the dispute, the Court shall determine which Paragraph is applicable in accordance with the standards of applicability set forth in Paragraphs 59 and 60.

59. Record Review. Formal dispute resolution for disputes pertaining to the selection or adequacy of any response action and all other disputes that are accorded review on the administrative record under applicable principles of administrative law shall be conducted pursuant to the procedures set forth in this Paragraph. For purposes of this Paragraph, the adequacy of any response action includes, without limitation, the adequacy or appropriateness of plans, procedures to implement plans, or any other items requiring approval by EPA under this Partial Consent Decree, and the adequacy of the performance of response actions taken pursuant to this Partial Consent Decree. Nothing in this Partial Consent Decree shall be construed to allow any dispute by Settling Defendants regarding the validity of the ROD's provisions.

a. An administrative record of the dispute shall be maintained by EPA and shall contain all statements of position, including supporting documentation, submitted pursuant to this Section. Where appropriate, EPA may allow submission of supplemental statements of position by the parties to the dispute.

b. The Director of the Superfund and Emergency Management Division, EPA Region IX, will issue a final administrative decision resolving the dispute based on the administrative record described in Paragraph 59.a. This decision shall be binding upon Settling Defendants, subject only to the right to seek judicial review pursuant to Paragraphs 59.c and 59.d.

c. Any administrative decision made by EPA pursuant to

Paragraph 59.b shall be reviewable by this Court, provided that a motion for judicial review of the decision is filed by Settling Defendants with the Court and served on all Parties within 20 Days of receipt of EPA's decision. The motion shall include a description of the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Partial Consent Decree. The United States may file a response to Settling Defendants' motion, and, if permitted by this Court's local rules, Settling Defendants may file a reply.

d. In proceedings on any dispute governed by this Paragraph, Settling Defendants shall have the burden of demonstrating that the decision of the Superfund and Emergency Management Division Director is arbitrary and capricious or otherwise not in accordance with law. Judicial review of EPA's decision shall be on the administrative record compiled pursuant to Paragraph 59.a.

60. Formal dispute resolution for disputes that neither pertain to the selection or adequacy of any response action nor are otherwise accorded review on the administrative record under applicable principles of administrative law shall be governed by this Paragraph.

a. Following receipt of Settling Defendants' Statement of Position submitted pursuant to Paragraph 58, the Director of the Superfund and Emergency Management Division, EPA Region IX, will issue a final decision resolving the dispute. The Superfund and Emergency Management Division Director's decision shall be binding on Settling Defendants unless, within 20 Days of receipt of the decision, Settling Defendants file with the Court and serve on the Parties a motion for judicial review of the decision setting forth the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Partial Consent Decree. The United States may file a

response to Settling Defendants' motion, and, if permitted by this Court's local rules, Settling Defendants may file a reply.

b. If Settling Defendants contest payment of any DTSC Future Response Costs, Settling Defendants shall comply with the procedures set forth in this Subparagraph. Prior to requesting formal dispute resolution pursuant to this Subparagraph, Settling Defendants shall notify DTSC's assigned Project Manager and attempt to informally resolve the dispute with DTSC's Project Manager and branch chief. If the dispute cannot be resolved informally within 20 Days, then Settling Defendants shall provide a written request for formal dispute resolution, which shall describe all issues in dispute and shall set forth the reasons for the dispute, both factual and legal. The written request for formal dispute resolution and any supporting documentation shall be sent to:

Chief, Collections and Resolutions Unit
Department of Toxic Substances Control
P.O. Box 806
Sacramento, California 95812-0806

c. Copies of the written request for formal dispute resolution and any supporting documentation shall also be sent to those persons designated by DTSC to receive notices and submissions in Section XXIV (Notices and Submissions) of this Partial Consent Decree. A decision on the billing dispute will be rendered by the Chief, Collections and Resolutions Unit or other DTSC designee. The decision by the Chief, Collections and Resolutions Unit or designee shall be binding on Settling Defendants unless, within 15 Days of the receipt of the decision, Settling Defendants file with the Court and serve on DTSC a motion for judicial review of the decision setting forth the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Partial Consent Decree.

d. Judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

61. The invocation of formal dispute resolution procedures under this Section shall not extend, postpone, or affect in any way any obligation of Settling Defendants under this Partial Consent Decree, not directly in dispute, unless EPA or the Court agrees otherwise. Stipulated penalties with respect to the disputed matter shall continue to accrue but payment shall be stayed pending resolution of the dispute as provided in Paragraph 69. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Partial Consent Decree. In the event that Settling Defendants do not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XVIII (Stipulated Penalties).

XVIII. STIPULATED PENALTIES

62. Settling Defendants shall be liable for stipulated penalties in the amounts set forth in Paragraphs 63 and 64 to the United States and DTSC, to be split 80%/20%, respectively, for failure to comply with the requirements of this Partial Consent Decree for Settling Defendants specified below, unless excused under Section XVI (Force Majeure). "Compliance" by Settling Defendants shall include completion of all payments and activities required for Settling Defendants under this Partial Consent Decree, or any plan, report, or other deliverable approved under this Partial Consent Decree, in accordance with all applicable requirements of law, this Partial Consent Decree, the SOW, and any plans, reports, or other deliverables approved under this Partial Consent Decree and within the specified time schedules established by and approved under this Partial Consent Decree.

63. <u>Stipulated Penalty Amounts – Work (Including Payments and Excluding Plans, Reports, and Other Deliverables)</u>.

a. The following stipulated penalties shall accrue per violation per

Day for any noncompliance identified in Paragraph 63.b:

Penalty Per Violation Per Day	Period of Noncompliance
$500	1st through 14th Day
$1000	15th through 30th Day
$3000	31st Day and beyond

b. Compliance Milestones. Failure of Settling Defendants to perform any of the following within the specified time schedule provided for in this Partial Consent Decree, the SOW, or its work plans shall result in stipulated penalties in the amounts set forth in Paragraph 63.a:

(1) Achievement of Performance Standards;

(2) Provision (by Settling Defendants) of access pursuant to Paragraph 19;

(3) Timely payment of EPA Past Response Costs and DTSC Past Response Costs;

(4) Timely payment of EPA Future Response Costs and DTSC Future Response Costs;

(5) Establishment of an escrow account to hold any disputed Future Response Costs under Paragraph 46.b; and

(6) Establishment and maintenance of performance guarantee in accordance with Paragraph 32.

64. Stipulated Penalty Amounts – Plans, Reports, and other Deliverables. The following stipulated penalties shall accrue per violation per Day for failure to submit timely or adequate reports or other plans or deliverables pursuant to this Partial Consent Decree:

Penalty Per Violation Per Day	Period of Noncompliance
$100	1st through 14th Day
$500	15th through 30th Day
$1000	31st Day and beyond

65. In the event that EPA assumes performance of a portion or all of the Work pursuant to Paragraph 77 (Work Takeover), Settling Defendants shall be liable for a stipulated penalty in the amount of $2,250,000. Stipulated penalties under this Paragraph are in addition to the remedies available under Paragraphs 36 (Funding for Work Takeover) and 77 (Work Takeover).

66. All penalties shall begin to accrue on the Day after the complete performance is due or the Day a violation occurs, and shall continue to accrue through the final Day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: (a) with respect to a deficient submission under Section IX (EPA Approval of Plans, Reports, and Other Deliverables), during the period, if any, beginning on the 31st Day after EPA's receipt of such submission until the date that EPA notifies Settling Defendants of any deficiency; (b) with respect to a decision by the Director of the Superfund and Emergency Management Division, EPA Region IX, under Paragraph 59.b or 60.a of Section XVII (Dispute Resolution), during the period, if any, beginning on the 21st Day after the date that the Settling Defendants' reply to EPA's Statement of Position is received until the date that the Director issues a final decision regarding such dispute; or (c) with respect to judicial review by this Court of any dispute under Section XVII (Dispute Resolution), during the period, if any, beginning on the 31st Day after the Court's receipt of the final submission regarding the dispute until the date that the Court issues a

final decision regarding such dispute. Nothing in this Partial Consent Decree shall prevent the simultaneous accrual of separate penalties for separate violations of this Partial Consent Decree.

67. Following EPA's determination that Settling Defendants have failed to comply with any of their obligations under this Partial Consent Decree, EPA may give Settling Defendants written notification of the same and describe the noncompliance. EPA and/or DTSC may send Settling Defendants a written demand for the payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA has notified Settling Defendants of a violation.

68. All penalties accruing under this Section shall be due and payable to the United States and DTSC within 30 Days of Settling Defendants' receipt from EPA of a demand for payment of the penalties, unless Settling Defendants invoke the Dispute Resolution procedures under Section XVII (Dispute Resolution) within the 30-Day period. All payments to the United States under this Section shall indicate that the payment is for stipulated penalties, and shall be made in accordance with Paragraphs 45.b and 45.c, and all payments to DTSC shall be made in accordance with Paragraph 42.c.

69. Penalties shall continue to accrue as provided in Paragraph 66 during any dispute resolution period, but need not be paid until the following:

a. If the dispute is resolved by agreement of the Parties or by a decision of EPA or DTSC that is not appealed to this Court, accrued penalties determined to be owed shall be paid to EPA and DTSC within 15 Days of the agreement or the receipt of EPA's decision or order;

b. If the dispute is appealed to this Court and the United States and/or DTSC prevails in whole or in part, Settling Defendants shall pay all accrued penalties determined by the Court to be owed to EPA and DTSC within 60 Days of receipt of the Court's decision or order, except as provided in

Paragraph 69.c;

c. If the District Court's decision is appealed by any Party, Settling Defendants shall pay all accrued penalties determined by the District Court to be owed to the United States and DTSC into an interest-bearing escrow account within 60 Days of receipt of the Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every 60 Days. Within 15 Days of receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to EPA and DTSC or to Settling Defendants to the extent that they prevail.

70. If Settling Defendants fail to pay stipulated penalties when due, Settling Defendants shall pay Interest on the unpaid stipulated penalties as follows: (a) if Settling Defendants timely invoked dispute resolution such that the obligation to pay stipulated penalties was stayed pending the outcome of dispute resolution, Interest shall accrue from the date stipulated penalties are due pursuant to Paragraph 69 until the date of payment; and (b) if Settling Defendants fail to timely invoke dispute resolution, Interest shall accrue from the date of demand under Paragraph 68 until the date of payment. If Settling Defendants fail to pay stipulated penalties and Interest when due, the United States or DTSC may institute proceedings to collect the penalties and Interest.

71. The payment of penalties and Interest, if any, shall not alter in any way Settling Defendants' obligation to complete the performance of the Work required under this Partial Consent Decree.

72. Nothing in this Partial Consent Decree shall be construed as prohibiting, altering, or in any way limiting the ability of the United States or DTSC to seek any other remedies or sanctions available by virtue of Settling Defendants' violation of this Partial Consent Decree or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Section 122(*l*) of CERCLA, 42 U.S.C. § 9622(*l*), or applicable

federal or California law, provided, however, that the United States shall not seek civil penalties pursuant to Section 122(*l*) of CERCLA for any violation for which a stipulated penalty is provided in this Partial Consent Decree, except in the case of a willful violation of this Partial Consent Decree.

73. Notwithstanding any other provision of this Section, the United States may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Partial Consent Decree.

XIX. COVENANTS BY PLAINTIFFS

74. Covenant for Settling Defendants by United States. In consideration of the actions that will be performed and the payments that will be made by Settling Defendants under this Partial Consent Decree, and except as specifically provided in Paragraph 76 (General Reservations of Rights), the United States covenants not to sue or to take administrative action against Settling Defendants pursuant to Sections 106 and 107(a) of CERCLA for the Work, EPA Past Response Costs, or EPA Future Response Costs. These covenants shall take effect upon the receipt by EPA of the payments required by Paragraph 42 (Payment by Settling Defendants for EPA Past Response Costs and DTSC Past Response Costs) and any Interest or stipulated penalties due thereon under Paragraph 47 (Interest) or Section XVIII (Stipulated Penalties). These covenants are conditioned upon the satisfactory performance by Settling Defendants of their obligations under this Partial Consent Decree. These covenants extend only to Settling Defendants and their successors and assigns and do not extend to any other person.

75. Covenants by DTSC. Except as specifically provided in Paragraph 76 (General Reservations of Rights), DTSC covenants not to sue or to take administrative action against Settling Defendants pursuant to Section 107(a) of CERCLA, 42 U.S.C. §9607(a), and Cal. Health & Safety Code Sections 25323.5, 25355.5, and 25360 for the Work, DTSC Past Response Costs, and DTSC Future

Response Costs. These covenants shall take effect upon payment to DTSC of all payments required from Settling Defendants by Paragraph 42.c (Payment of DTSC Past Response Costs) and any Interest or stipulated penalties due thereon under Paragraph 47 (Interest) or Section XVIII (Stipulated Penalties). These covenants are conditioned upon the satisfactory performance by Settling Defendants of their obligations under this Partial Consent Decree. These covenants extend only to Settling Defendants and their successors and assigns and do not extend to any other person.

76. General Reservations of Rights. The United States and the State reserve, and this Partial Consent Decree is without prejudice to, all rights against Settling Defendants, with respect to all matters not expressly included within Plaintiffs' covenants. Notwithstanding any other provision of this Partial Consent Decree, the United States and the State reserve all rights against Settling Defendants, with respect to:

a. liability for failure by Settling Defendants to meet a requirement of this Partial Consent Decree;

b. liability arising from the past, present, or future disposal, release, or threat of release of Waste Material outside of the Dual Site;

c. liability based on the ownership or operation of any portion of the Dual Site by Settling Defendants when such ownership or operation commences after signature of this Partial Consent Decree;

d. liability based on Settling Defendants' transportation, treatment, storage, or disposal, or the arrangement for the transportation, treatment, storage, or disposal of Waste Material at or in connection with the Dual Site, other than as provided in the ROD, the Work, or otherwise ordered by EPA, after signature of this Partial Consent Decree;

e. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

f. criminal liability;

g. liability for violations of federal or state law which occur during or after implementation of the Work;

h. liability, prior to Certification of Completion of the Work, for additional response actions that EPA determines are necessary to achieve and maintain the Performance Standards or to carry out and maintain the effectiveness of the relevant remedy components set forth in the ROD relating to the Chlorobenzene Plume, but that cannot be required pursuant to Paragraph 14 (Modification of SOW or Related Work Plans);

i. liability for the Remaining Work, vapor intrusion, DNAPL and for any other operable unit at the Montrose Chemical Corp. Superfund Site or the final response action;

j. liability for costs that the United States or DTSC will incur, or have incurred, after July 31, 2019, or September 30, 2019, respectively, regarding the Dual Site but that are not within the definition of EPA Future Response Costs or DTSC Future Response Costs;

k. liability for costs incurred or to be incurred by the Agency for Toxic Substances and Disease Registry regarding the Dual Site; and

l. liability for claims or defenses as described in Paragraph 81.b.

77. Work Takeover.

a. In the event EPA determines that Settling Defendants (1) have ceased implementation of any portion of the Work for which they are responsible, (2) are seriously or repeatedly deficient or late in their performance of the Work, or (3) are implementing the Work in a manner that may cause an endangerment to human health or the environment, EPA may issue a written notice ("Work Takeover Notice") to Settling Defendants. Any Work Takeover Notice issued by EPA will specify the grounds upon which such notice was issued and will provide Settling Defendants a period of 20 Days within which to

remedy the circumstances giving rise to EPA's issuance of such notice.

b. If, after expiration of the 20-Day notice period specified in Paragraph 77.a, Settling Defendants have not remedied to EPA's satisfaction the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, EPA may at any time thereafter assume the performance of all or any portion(s) of the Work as EPA deems necessary ("Work Takeover"). EPA will notify Settling Defendants in writing (which writing may be electronic) if EPA determines that implementation of a Work Takeover is warranted under this Paragraph. Funding of Work Takeover costs is addressed under Paragraph 36.

c. Settling Defendants may invoke the procedures set forth in Paragraph 59 (Record Review) to dispute EPA's implementation of a Work Takeover under Paragraph 77.b. However, notwithstanding Settling Defendants' invocation of such dispute resolution procedures, and during the pendency of any such dispute, EPA may in its sole discretion commence and continue a Work Takeover under Paragraph 77.b until the earlier of (1) the date that the Settling Defendants remedy, to EPA's satisfaction, the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, or (2) the date that a final decision is rendered in accordance with Paragraph 59 (Record Review) requiring EPA to terminate such Work Takeover.

78. Notwithstanding any other provision of this Partial Consent Decree, the United States and the State retain all authority and reserve all rights to take any and all response actions authorized by law.

XX. COVENANTS BY SETTLING DEFENDANTS

79. Covenant Not to Sue by Settling Defendants. Subject to the reservations in Paragraph 81, Settling Defendants hereby covenant not to sue and agree not to assert any claims or causes of action against the United States or DTSC, or their contractors and employees, with respect to the Work, past response actions regarding the Dual Site, EPA Past Response Costs, EPA Future

Response Costs, DTSC Past Response Costs, DTSC Future Response Costs, and this Partial Consent Decree, including, but not limited to:

a. any direct or indirect claim for reimbursement from the Hazardous Substance Superfund (established pursuant to the Internal Revenue Code, 26 U.S.C. § 9507) through CERCLA Sections 106(b)(2), 107, 111, 112, 113 (42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, 9613) or any other provision of law;

b. any claims against the United States, including any department, agency or instrumentality of the United States, or DTSC under CERCLA Sections 107 or 113, 42 U.S.C. §§ 9607 and 9613, RCRA Section 7002(a), 42 U.S.C. § 6972(a), or state law regarding the Work, past response actions regarding the Dual Site, EPA Past Response Costs, EPA Future Response Costs, DTSC Past Response Costs, DTSC Future Response Costs, and this Partial Consent Decree; or

c. any claims arising out of response actions at or in connection with the Work, past response actions regarding the Dual Site, EPA Past Response Costs, EPA Future Response Costs, DTSC Past Response Costs, DTSC Future Response Costs, and this Partial Consent Decree, including any claim under the United States Constitution, the State Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, as amended, or at common law.

80. Except as provided in Paragraph 90 (Res Judicata and Other Defenses), the covenants in this Section shall not apply if the United States or DTSC brings a cause of action or issues an order pursuant to any of the reservations in Section XIX (Covenants by Plaintiffs), other than in Paragraphs 76.a (claims for failure to meet a requirement of the Decree), 76.f (criminal liability), and 76.g (violations of federal/state law during or after implementation of the Work), but only to the extent that Settling Defendants' claims arise from

the same response action, response costs, or damages that the United States or DTSC is seeking pursuant to the applicable reservation.

81. Settling Defendants' Reservations.

a. Settling Defendants reserve, and this Partial Consent Decree is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, and brought pursuant to any statute other than CERCLA or RCRA and for which the waiver of sovereign immunity is found in a statute other than CERCLA or RCRA, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States, as that term is defined in 28 U.S.C. § 2671, while acting within the scope of his or her office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, the foregoing shall not include any claim based on EPA's selection of response actions, or the oversight or approval of Settling Defendants' plans, reports, other deliverables or activities.

b. Notwithstanding the foregoing, Settling Defendants specifically reserve contribution claims against the General Services Administration under CERCLA, for the equitable allocation of costs of performing the Work that arise out of releases of benzene or other chemicals from or at the Del Amo Superfund Site. In the event that any Settling Defendant should bring contribution claims against the General Services Administration as described above, or claims as described in Paragraph 81.a above, the United States reserves the right to bring claims or counterclaims arising from, or responding to, such claims, and reserves all defenses available to such claims.

82. Nothing in this Partial Consent Decree shall be deemed to constitute preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

83. Claims Against De Micromis Parties. Settling Defendants agree not to assert any claims and to waive all claims or causes of action (including but not limited to claims or causes of action under Sections 107(a) and 113 of CERCLA) that they may have for all matters relating to the Dual Site against any person where the person's liability to Settling Defendants with respect to the Dual Site is based solely on having arranged for disposal or treatment, or for transport for disposal or treatment, of hazardous substances at the Dual Site, or having accepted for transport for disposal or treatment of hazardous substances at the Dual Site, if all or part of the disposal, treatment, or transport occurred before April 1, 2001, and the total amount of material containing hazardous substances contributed by such person to the Dual Site was less than 110 gallons of liquid materials or 200 pounds of solid materials.

84. The waiver in Paragraph 83 (Claims Against De Micromis Parties) shall not apply with respect to any defense, claim, or cause of action that a Settling Defendant may have against any person meeting the criteria in Paragraph 83 if such person asserts a claim or cause of action relating to the Dual Site against such Settling Defendant. This waiver also shall not apply to any claim or cause of action against any person meeting the criteria in Paragraph 83 if EPA determines:

a. that such person has failed to comply with any EPA requests for information or administrative subpoenas issued pursuant to Section 104(e) or 122(e) of CERCLA, 42 U.S.C. § 9604(e) or 9622(e), or Section 3007 of RCRA, 42 U.S.C. § 6927, or has impeded or is impeding, through action or inaction, the performance of a response action or natural resource restoration with respect to the Dual Site, or has been convicted of a criminal violation for the conduct to which this waiver would apply and that conviction has not been vitiated on appeal or otherwise; or

b. that the materials containing hazardous substances contributed to

the Dual Site by such person have contributed significantly, or could contribute significantly, either individually or in the aggregate, to the cost of response action or natural resource restoration at the Dual Site.

XXI. EFFECT OF SETTLEMENT; CONTRIBUTION

85. Nothing in this Partial Consent Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Partial Consent Decree. Except as provided in Paragraph 83 (Claims Against De Micromis Parties), each of the Parties expressly reserves any and all rights (including, but not limited to, pursuant to Section 113 of CERCLA, 42 U.S.C. § 9613), defenses, claims, demands, and causes of action which each of them may have with respect to any matter, transaction, or occurrence relating in any way to the Dual Site against any person not a Party hereto. Nothing in this Partial Consent Decree diminishes the right of the United States or the State, pursuant to Section 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613(f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).

86. The Parties agree, and by entering this Partial Consent Decree this Court finds, that this Partial Consent Decree constitutes a judicially-approved settlement pursuant to which each Settling Defendant has, as of the Effective Date, resolved liability to the Plaintiffs within the meaning of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and that each Settling Defendant is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Section 113(f)(2) of CERCLA, or as may be otherwise provided by law, for "matters addressed" in this Partial Consent Decree. The "matters addressed" in this Partial Consent Decree are the Work, EPA Past Response Costs, EPA Future Response Costs, DTSC Past Response Costs, and DTSC Future Response Costs.

87. The Parties further agree, and by entering this Partial Consent Decree this Court finds, that the complaint filed by the Plaintiffs in this action is a civil action within the meaning of Section 113(f)(1) of CERCLA, 42 U.S.C. § 9613(f)(1), and that this Partial Consent Decree constitutes a judicially-approved settlement pursuant to which each Settling Defendant has, as of the Effective Date, resolved liability to the Plaintiffs within the meaning of Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).

88. Each Settling Defendant shall, with respect to any suit or claim brought by it for matters related to this Partial Consent Decree, notify the United States and DTSC in writing no later than 60 Days prior to the initiation of such suit or claim.

89. Each Settling Defendant shall, with respect to any suit or claim brought against it for matters related to this Partial Consent Decree, notify in writing the United States and DTSC within ten Days of service of the complaint on such Settling Defendant. In addition, each Settling Defendant shall notify the United States and DTSC within ten Days of service or receipt of any Motion for Summary Judgment and within ten Days of receipt of any order from a court setting a case for trial.

90. <u>Res Judicata and Other Defenses</u>. In any subsequent administrative or judicial proceeding initiated by the United States or the State for injunctive relief, recovery of response costs, or other appropriate relief relating to the Site, Settling Defendants shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States or the State in the subsequent proceeding were or should have been brought in the instant case; provided, however, that nothing in this Paragraph affects the enforceability of the covenants not to sue set forth in Section XIX (Covenants by Plaintiffs).

91. As of the Effective Date, this Partial Consent Decree resolves the following disputes brought by Montrose pursuant to Paragraph 62 of the Construction CD: (i) Notice of Dispute dated February 11, 2015; and (ii) Supplemental Notice of Dispute dated December 31, 2018. As of the date of lodging of this Partial Consent Decree, the disputes above are held in abeyance, and any informal negotiation period (as described in the Construction CD) for these disputes is extended from the date of lodging until the Effective Date of this Partial Consent Decree. These disputes shall not be reactivated unless (a) the United States or DTSC withdraws its consent to this Partial Consent Decree pursuant to Paragraph 106 (Section XXIX, Lodging and Opportunity for Public Comment), or (b) the Court disapproves this Partial Consent Decree.

XXII. ACCESS TO INFORMATION

92. Settling Defendants shall provide to EPA and DTSC, upon request, copies of all non-privileged records, reports, documents, and other information (including records, reports, documents, and other information in electronic form) (hereinafter referred to as "Records") within their possession or control or that of their contractors or agents relating to activities at the Dual Site or to the implementation of this Partial Consent Decree, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information regarding the Work and the Remaining Work. Settling Defendants shall also make available to EPA and DTSC, for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work or the Remaining Work.

93. Business Confidential and Privileged Documents.

a. Settling Defendants may assert business confidentiality claims covering part or all of the Records submitted to Plaintiffs under this Partial

Consent Decree to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Records determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B; records determined to be confidential by DTSC will be afforded the protection specified in the California Public Records Act, California Government Code § 6250, *et seq*. If no claim of confidentiality accompanies Records when they are submitted to EPA and DTSC, or if EPA has notified Settling Defendants that the Records are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, or if DTSC has notified Settling Defendants that the Records are not confidential under the standards of the California Public Records Act, California Government Code § 6250, *et seq*., the public may be given access to such Records without further notice to Settling Defendants.

b. Settling Defendants may assert that certain Records are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Settling Defendants assert such a privilege in lieu of providing Records, they shall provide Plaintiffs with the following: (1) the title of the Record; (2) the date of the Record; (3) the name, title, affiliation (e.g., company or firm), and address of the author of the Record; (4) the name and title of each addressee and recipient; (5) a description of the contents of the Record; and (6) the privilege asserted by Settling Defendants. If a claim of privilege applies only to a portion of a Record, the Record shall be provided to the United States and the State in redacted form to mask the privileged portion only. Settling Defendants shall retain all Records that they claim to be privileged until the United States or the State has had a reasonable opportunity to dispute the privilege claim and any such dispute has been resolved in Settling Defendants' favor.

c. No Records created or generated pursuant to the requirements of

this Partial Consent Decree shall be withheld from the United States or DTSC on the grounds that they are privileged or confidential.

94. No claim of confidentiality or privilege shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Dual Site.

95. If relevant to the proceeding, the Parties agree that validated sampling data generated in accordance with the SOW and reviewed and approved by EPA shall be admissible as evidence, without objection, in any proceeding under this Partial Consent Decree.

96. Notwithstanding any provision of this Partial Consent Decree, the United States and the State retain all of their information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA, and any other applicable federal or California statutes or regulations.

XXIII. RETENTION OF RECORDS

97. Until 15 years after Settling Defendants' receipt of EPA's notification pursuant to Paragraph 39.b (Completion of the Work), each Settling Defendant shall preserve and retain all non-identical copies of Records (including Records in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to its liability under CERCLA with respect to the Dual Site, provided, however, that Settling Defendants who are potentially liable as owners or operators of the Dual Site must retain, in addition, all Records that relate to the liability of any other person under CERCLA with respect to the Dual Site. Each Settling Defendant must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above all non-identical copies of the last draft or final version of any Records (including Records in electronic form) now in its possession or

control or which come into its possession or control that relate in any manner to the performance of the Work, provided, however, that each Settling Defendant (and its contractors and agents) must retain, in addition, copies of all data generated during the performance of the Work and not contained in the aforementioned Records required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.

98. At the conclusion of this record retention period, Settling Defendants shall notify the United States and the State at least 90 Days prior to the destruction of any such Records, and, upon request by the United States or the State, Settling Defendants shall deliver any such Records to EPA or the State. Settling Defendants may assert that certain Records are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Settling Defendants assert such a privilege, they shall provide Plaintiffs with the following: (a) the title of the Record; (b) the date of the Record; (c) the name, title, affiliation (e.g., company or firm), and address of the author of the Record; (d) the name and title of each addressee and recipient; (e) a description of the subject of the Record; and (f) the privilege asserted by Settling Defendants. If a claim of privilege applies only to a portion of a Record, the Record shall be provided to the United States and the State in redacted form to mask the privileged portion only. Settling Defendants shall retain all Records that they claim to be privileged until the United States or the State has had a reasonable opportunity to dispute the privilege claim and any such dispute has been resolved in Settling Defendants' favor.

99. Each Settling Defendant certifies individually that, to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed or otherwise disposed of any Records (other than identical copies) relating to its potential liability regarding the Dual Site since the earlier of

notification of potential liability by the United States or the State or the filing of suit against it regarding the Dual Site and that it has fully complied with any and all EPA requests for information pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927.

XXIV. NOTICES AND SUBMISSIONS

100. Whenever, under the terms of this Partial Consent Decree, written notice is required to be given or a report or other document is required to be sent by one Party to another, it shall be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Parties in writing. All notices and submissions shall be considered effective upon receipt, unless otherwise provided. Written notice as specified in this Section shall constitute complete satisfaction of any written notice requirement of this Partial Consent Decree with respect to the United States, EPA, DTSC, and Settling Defendants, respectively. Notices required to be sent to EPA, and not to the United States, under the terms of this Partial Consent Decree should not be sent to the U.S. Department of Justice.

As to the United States:	EES Case Management Unit U.S. Department of Justice Environment and Natural Resources Division P.O. Box 7611 Washington, D.C. 20044-7611 eescdcopy.enrd@usdoj.gov Re: DJ # 90-11-2-933/3

and:

Enrique Manzanilla
Director, Superfund and Emergency Management Division
United States Environmental Protection Agency
Region IX
75 Hawthorne St. (SFD-1)
San Francisco, CA 94105
Manzanilla.enrique@epa.gov

As to EPA:

Yarissa Martinez
EPA Project Coordinator
United States Environmental Protection Agency
Region IX
600 Wilshire Blvd. Suite 940 (SFD-7-2)
Los Angeles, CA 90017
Martinez.yarissa@epa.gov

As to the EPA Regional Financial Management Officer:

Marie Ortesi
United States Environmental Protection Agency
Region IX
75 Hawthorne St.
San Francisco, CA 94105

As to DTSC:

Peter Garcia
DTSC Division Chief
Site Mitigation and Restoration Program
ATTN: Willard Garrett
DTSC Project Manager
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630
Willard.Garrett@dtsc.ca.gov

As to Settling Defendants:

Joseph C. Kelly
Montrose Chemical Corporation of California
600 Eriksen Avenue NE, Suite 380
Bainbridge Island, WA 98110

Kelly E. Richardson
Latham & Watkins LLP
12670 High Bluff Drive
San Diego, CA 92130

Charles N. Elmendorf
President
Stauffer Management Company LLC and as attorney-in-fact for Bayer CropScience Inc.
1800 Concord Pike
PO Box 15437
FOP 2-311
Wilmington, DE 19850-5437

Gregg D. Zucker
Foundation Law Group
2049 Century Park East, Suite 2460
Los Angeles, CA 90067

J. Wylie Donald
McCarter & English, LLP
1301 K Street NW, Suite 1000 West
Washington, DC 20005

Jeffrey A. Taylor
Executive Vice President and Chief Litigation Counsel
Fox Corporation
10201 W Pico Blvd.
Los Angeles, CA 90067

Winston P. Hsiao
Skadden, Arps, Slate, Meagher & Flom LLP
300 South Grand Avenue, Suite 3400
Los Angeles, CA 90071

Stacy Kray
Skadden, Arps, Slate, Meagher & Flom LLP
525 University Avenue, Suite 1400
Palo Alto, CA 94301

Christopher Suh
Principal Counsel
The Walt Disney Company
500 South Buena Vista St., MC 1247
Burbank, CA 91521

Janene Bassett
Assistant General Counsel
The Walt Disney Company
2121 Ave. of the Stars, Suite 700
Los Angeles, CA 90067

George J. Gigounas
DLA Piper LLP (US)
555 Mission Street, Suite 2400
San Francisco, CA 94105

XXV. RETENTION OF JURISDICTION

101. This Court retains jurisdiction over both the subject matter of this Partial Consent Decree and Settling Defendants for the duration of the performance of the terms and provisions of this Partial Consent Decree for the purpose of enabling any of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or modification of this Partial Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XVII (Dispute Resolution).

XXVI. APPENDICES

102. The following appendices are attached to and incorporated into this Partial Consent Decree:

"Appendix A" is Volume One of the ROD (excluding Volume Two, Response Summary) and the Flowrate Memo.

"Appendix B" is the SOW.

"Appendix C" is the description and/or map of the Dual Site.

"Appendix D" is the form of the performance guarantee.

XXVII. COMMUNITY RELATIONS

103. If requested by EPA or DTSC, Settling Defendants shall participate in community relations activities pursuant to the community relations plan ("Plan") to be developed by EPA. EPA, in consultation with DTSC, will determine the appropriate role for Settling Defendants under the Plan. Settling Defendants shall also cooperate with EPA and DTSC in providing information regarding the Work to the public. As requested by EPA or DTSC, Settling Defendants shall participate in the preparation of such information for dissemination to the public and in public meetings which may be held or sponsored by EPA or DTSC to explain activities at or relating to the Dual Site or the Work. Costs incurred by the United States or DTSC under this Section, including the costs of any technical assistance grant under Section 117(e) of CERCLA, 42 U.S.C. § 9617(e), shall be considered EPA Future Response Costs that Settling Defendants shall pay pursuant to Section XIV (Payments for Response Costs).

XXVIII. MODIFICATION

104. Except as provided in Paragraph 14 (Modification of SOW or Related Work Plans), material modifications to this Partial Consent Decree, including the SOW, shall be in writing, signed by the United States, DTSC, and

the Settling Defendants, and shall be effective upon approval by the Court. Except as provided in Paragraph 14 (Modification of SOW or Related Work Plans), schedule modifications and non-material modifications to this Partial Consent Decree, including the SOW, shall be in writing and shall be effective when signed by duly authorized representatives of the United States, DTSC, and Settling Defendants. All modifications to this Partial Consent Decree, other than the SOW, also shall be signed by DTSC, or a duly authorized representative of DTSC, as appropriate. A modification to the SOW shall be considered material if it fundamentally alters the basic features of the selected remedy within the meaning of 40 C.F.R. § 300.435(c)(2)(ii). Before providing its approval to any modification to the SOW, the United States will provide DTSC with a reasonable opportunity to review and comment on the proposed modification.

105. Nothing in this Partial Consent Decree shall be deemed to alter the Court's power to enforce, supervise or approve modifications to this Partial Consent Decree.

XXIX. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

106. This Partial Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with Section 122(d)(2) of CERCLA, 42 U.S.C. § 9622(d)(2), and 28 C.F.R. § 50.7. The United States and DTSC reserve the right to withdraw or withhold their consent if the comments regarding this Partial Consent Decree disclose facts or considerations which indicate that this Partial Consent Decree is inappropriate, improper, or inadequate. Settling Defendants consent to the entry of this Partial Consent Decree without further notice.

107. If for any reason the Court should decline to approve this Partial Consent Decree in the form presented, this agreement is voidable at the sole discretion of any Party and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXX. SIGNATORIES/SERVICE

108. Each undersigned representative of a Settling Defendant to this Partial Consent Decree, the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice, and the California Department of Toxic Substances Control certifies that he or she is fully authorized to enter into the terms and conditions of this Partial Consent Decree and to execute and legally bind such Party to this document.

109. Each Settling Defendant agrees not to oppose entry of this Partial Consent Decree by this Court or to challenge any provision of this Partial Consent Decree unless the United States has notified Settling Defendants in writing that it no longer supports entry of this Partial Consent Decree.

110. This Partial Consent Decree will be filed in *U.S. et al. vs. Montrose Chemical Corp. of California et al.*, Case No. 2:90-cv-03122 DOC (GJS), through the Court's electronic filing service. Settling Defendants agree to accept service in that manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable local rules of this Court, including, but not limited to, service of a summons. All other court filings will be served through the Court's electronic filing service. Settling Defendants need not file an answer to the complaint in this action unless or until the Court expressly declines to enter this Partial Consent Decree.

XXXI. FINAL JUDGMENT

111. This Partial Consent Decree and its appendices constitute the final, complete, and exclusive agreement and understanding among the Parties regarding the settlement embodied in this Partial Consent Decree. The Parties acknowledge that there are no representations, agreements or understandings relating to the settlement other than those expressly contained in this Partial Consent Decree.

112. Upon entry of this Partial Consent Decree by the Court, this Partial

Consent Decree shall constitute a final judgment between and among the United States, the State, and Settling Defendants. The Court finds that there is no just reason for delay and therefore enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

SO ORDERED THIS __ DAY OF _______, 20__.

____
HONORABLE DAVID O. CARTER
United States District Judge

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR THE UNITED STATES OF AMERICA:

JEFFREY BOSSERT CLARK
Assistant Attorney General
Environment & Natural Resources Division
United States Department of Justice
950 Pennsylvania Ave., NW
Washington, DC 20530-0001

August 6, 2020
Date:

Deborah A. Gitin

GABRIEL M. ALLEN
Senior Attorney
DEBORAH A. GITIN
Senior Counsel
Environmental Enforcement Section
Environment & Natural Resources Division
United States Department of Justice
301 Howard St., Suite 1050
San Francisco, CA 94105

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR THE ENVIRONMENTAL PROTECTION AGENCY:

July 31, 2020

Date: ____________

ENRIQUE MANZANILLA
Director, Superfund and Emergency Management Division
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

July 31, 2020

Date: ____________

XIAO ZHANG
Assistant Regional Counsel
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR THE STATE OF CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

07/31/2020
Date:

GRANT COPE
Deputy Director
Site Mitigation and Restoration Program
Department of Toxic Substances Control
P.O. Box 806
1001 I Street, 25th Floor
Sacramento, California 95812-0806

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR MONTROSE CHEMICAL CORPORATION OF CALIFORNIA

May 27, 2020

Date:

JOSEPH C. KELLY
President
6000 Eriksen Avenue NE, Suite 380
Bainbridge Island, WA 98110

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR TFCF AMERICA, INC.

6/3/2020
Date:

AARON SOLOMON
Assistant Secretary
TFCF America, Inc.
1170 Celebration Blvd. Floor 01
Celebration, FL 34747

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR STAUFFER MANAGEMENT COMPANY LLC

DocuSigned by:

Charles Elmendorf

CFC4CC7EB6A643C...

27 May 2020

Date:

CHARLES ELMENDORF
President
1800 Concord Pike
PO Box 15437
FOB 2-311
Wilmington, DE 19850-5437

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR BAYER CROPSCIENCE INC.

27 May 2020

DocuSigned by:
Charles Elmendorf
CFC4CC7EB6A643C...
President, Stauffer Management Company LLC
as litigation agent for Bayer CropScience Inc.

Date:

CHARLES ELMENDORF
President
1800 Concord Pike
PO Box 15437
FOB 2-311
Wilmington, DE 19850-5437

THE UNDERSIGNED PARTY enters into this Partial Consent Decree in the matter of *United States of America and State of California v. Montrose Chemical Corp. of California, et al.*

FOR JCI JONES CHEMICALS, INC.

June 3, 2020
Date:

TIMOTHY J. GAFFNEY
Executive Vice President
100 Sunny Sol Boulevard
Caledonia, NY 14423

Appendix A

(Volume One of the ROD (excluding Volume Two, Response Summary) and the Flowrate Memo)

United States
Environmental Protection Agency
Region IX

Record of Decision

for

Dual Site
Groundwater Operable Unit

Montrose Chemical and Del Amo Superfund Sites

Volume I:
Declaration and Decision Summary

Prepared By
Jeff Dhont
Remedial Project Manager
March 1999

Record of Decision: Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Contents*

VOLUME 1: Declaration and Decision Summary

* Contents for both volumes of this ROD are shown. This is Volume 1. Volume 2 is under separate cover.

Acronyms

AOC	Administrative Order on Consent
ARARs	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BHC	benzene hexachloride
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Act Information System
C.F.R.	Code of Federal Regulations
CIC	community involvement coordinator
CPA	Central Process Area of the former Montrose Plant
CPF	cancer potency factor
DCA	dichloroethane
**See below*	
DCE	dichloroethylene
DDT	dichlorodiphenyl-trichloroethane
DNAPL	dense nonaqueous phase liquid
Dow	Dow Chemical Corporation
DTSC	California Department of Toxic Substances Control
FBR	Fluidized Bed Reactor
FSP	field sampling plan
FTC	focused transport calibration
gpm	gallons per minute
GSA	United States General Services Administration
ISGS	in-situ groundwater standards
JGWFS	Joint Groundwater Feasibility Study
JGWRA	Joint Groundwater Risk Assessment
LBF	Lower Bellflower Aquitard
LGAC	liquid-phase granular activated carbon
LNAPL	light nonaqueous phase liquid
MBFB Sand	Middle Bellflower "B" Sand
MBFC Sand	Middle Bellflower "C" Sand
MBFM	Middle Bellflower Muds
MCL	maximum contaminant level (promulgated drinking water standard)
µg/L	micrograms per liter
mg/kg/day	milligrams per kilogram per day
mg/L	milligrams per liter
NAPL	nonaqueous phase liquid

NCEA	National Center for Exposure Assessment
NCP	National Contingency Plan
NOEL	No Observed Adverse Effect Level
NRRB	National Remedy Review Board
O&M	operations & maintenance
OSHA	Occupational Safety and Health Administration
pCBSA	para-chlorobenzene sulfonic acid
PCE	perchloroethylene
ppb	parts per billion
PRG	Preliminary Risk Goal
PRP	potentially responsible party
QAPP	Quality Assurance Project Plan
RCRA	Resource, Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RME	reasonable maximum exposure
RMS	root mean square
ROD	Record of Decision
ROST™	Rapid Optical Screening Tool
RPM	remedial project manager
Shell	Shell Oil Company
SVE	soil vapor extraction
TBC	To-Be-Considered Criterion
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TI	technical impracticability
UBF	Upper Bellflower
U.S.C.	United States Code
VOCs	volatile organic compounds

*Note: The term "Del Amo Respondents" refers to Shell Oil Company and Dow Chemical Company, collectively.

I. DECLARATION

Statutory Preference for Treatment
as a Principal Element is Met
and Five Year Reviews Are Required

1. Site Name and Location

This Record of Decision (ROD) applies to *both* the Montrose Chemical Superfund Site and the Del Amo Superfund Site, in Los Angeles County, California. Portions of these sites lie within the City of Los Angeles, and adjacent to the City of Torrance, California.

2. Statement of Basis and Purpose

This ROD presents the selected remedial action for (1) groundwater contamination, and (2) isolation and containment of non-aqueous phase liquids (NAPL) at the Montrose Chemical and Del Amo Superfund Sites. EPA has selected this remedy in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, P.L. 99-499, 100 Stat. 1613 (1986) (CERCLA) and with the relevant provisions of the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300 (NCP). This decision is based on consideration of the administrative record, including public comments and the detailed analysis of the alternatives which are discussed and summarized in the Decision Summary.

This ROD establishes a *dual-site operable unit remedy*. This operable unit remedy is anticipated to be consistent with any other operable unit remedies, and the final remedies, for both the Montrose Chemical Superfund Site and the Del Amo Superfund Site. Such other remedies may apply to one or the other site individually, in contrast to the dual-site nature of this remedy.

This document identifies applicable or relevant and appropriate requirements (ARARs) and other criteria and requirements which shall be met in implementing this remedy. During investigations of the Montrose Chemical and Del Amo Superfund Sites, data has been collected in accordance with approved sampling and quality assurance management plans. EPA considers site data to be of adequate quality to support the remedy presented in this ROD. Remedial designs, actions, and operation and maintenance undertaken in the course of implementing this remedy shall comply with all standards, requirements and specifications in this ROD.

The State of California, acting by and through its Department of Toxic Substances Control, concurs with the remedy selected in this document.

The authority to select CERCLA remedial actions has been delegated to the U.S. EPA Region IX Superfund Division Director *(See* U.S. EPA CERCLA Delegations Manual, Delegation 14.5 (April 15, 1994) and redelegated by EPA Region IX Delegation Order, Selection of Remedial Actions (September 29, 1997)).

3. Assessment of the Site

Releases of hazardous substances, pollutants or contaminants from the former DDT pesticide manufacturing plant operated by Montrose Chemical Corporation, including but not limited to chlorobenzene, DDT, and parachlorobenzene sulfonic acid, have resulted in hazardous substances contamination in the groundwater. Releases of hazardous substances from the former Del Amo Synthetic Rubber Manufacturing plant, including but not limited to benzene, ethylbenzene, and naphthalene have resulted in hazardous substances contamination in the groundwater. Releases of hazardous substances including but not limited to benzene, trichloroethylene (TCE), perchloroethylene (PCE), and dichloroethylene (DCE) have occurred potentially as a result of the operations at both the former Montrose Chemical and Del Amo plant properties and otherwise as a result of the operations of additional facilities in the immediately surrounding area. These releases have also resulted in groundwater contamination. Some of the hazardous substances discussed above are present below the ground surface in the form of non-aqueous phase liquids (NAPL) as well as dissolved in water and adsorbed to soils.

Contamination in groundwater from the two sites has partially commingled, or merged. Remedial actions selected for the contamination originating from either site individually would affect the contamination, execution, and implications of remedial actions selected for the contamination originating from the other site. The groundwater contamination from both sites is being addressed by EPA as a single technical problem with a unified remedial strategy which has been developed in part by considering the interrelationships of the various areas of groundwater at the Montrose Chemical and Del Amo Superfund Sites.

The groundwater contamination at and from the former Montrose and Del Amo plant properties; and the contamination from additional sources that is commingled, or within the area that might be subject to significant hydraulic influences from this remedy; are collectively referred to by EPA as "the Joint Site." This term is being used only with respect to this selected groundwater remedy. Additional description and caveats pertaining to the use of this term are provided in the Decision Summary of this ROD. Unless otherwise noted, where used in this ROD the term "both sites," shall refer to the Montrose Chemical Superfund Site and the Del Amo Superfund Site.

Actual or threatened releases of hazardous substances from both the Montrose Chemical Superfund Site and the Del Amo Superfund Site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public

health, welfare, or the environment.

4. Description of the Remedy

The implementation of the remedial actions selected by this ROD shall meet the description and all specifications and requirements as provided in this section, and the accompanying Decision Summary. The Decision Summary contains more detail on remedy description.

The primary principal threat at both of these sites related to groundwater is the NAPL which continues to dissolve into the groundwater. The dissolved contamination in the groundwater poses an unacceptable potential human health risk over the long term.. This selected remedial action is the first of two phases of remedial decisionmaking for the groundwater operable unit of the Montrose Chemical and Del Amo Superfund Sites. This ROD selects remedial actions that will:

- Contain the principal threat by containing the dissolved-phase groundwater contamination that surrounds the NAPL, thereby isolating the NAPL;
- Reduce the concentrations of dissolved contaminants in groundwater, outside the area of groundwater being contained, to levels that no longer pose an unacceptable health risk; and
- Prevent human exposure to groundwater contamination at these Superfund sites.

The containment of the principal threat shall be accomplished by (1) hydraulic extraction and treatment (with aquifer injection), and (2) reliance on intrinsic biodegradation, a form of natural attenuation. The manner in which each of these shall be applied is specified in the Decision Summary.

The reduction of concentrations of dissolved contaminants outside the area of groundwater being contained shall be accomplished by hydraulic extraction, treatment, and aquifer injection. This reduction shall occur at rates and meet time- and efficiency-based performance requirements specified in the Decision Summary. Some treated water may under this remedial action also may be discharged under permit to surface water channels. Provisions for institutional controls, monitoring, additional data acquisition, acceptable forms of groundwater treatment, and waivers of certain ARARs based on technical impracticability, shall also apply to this remedial action as specified in the Decision Summary.

EPA has determined that the remedial action selected in this ROD is protective of human health and the environment. However, the remedial action selected by this ROD does not remove NAPL

from the ground nor immobilize it. As extensively discussed in the Decision Summary, the remedial action selected by this ROD will remain in place over an extended time frame. The existing mass of NAPL and the potential for NAPL migration create significant uncertainties that the remedial action selected in this ROD will continue to remain protective of human health and the environment over the long term. To address such uncertainties, EPA will undertake a second phase of remedial decisionmaking for this groundwater operable unit, which will address whether and to what degree NAPL shall be recovered (removed) from the ground and/or immobilized at each of the two sites. Recovery and/or immobilization of the NAPL may enhance the long-term effectiveness of the remedial action selected in this ROD and may reduce these long-term uncertainties. If, as a result of such evaluations, EPA determines that additional remedial actions are required, EPA will select the second phase remedial actions in an *amendment* to this ROD. EPA may issue such an amendment, if any, as a stand-alone document or within the framework of another ROD for the Montrose and Del Amo site, including final site-wide ROD(s) which may be issued.

Performance of the second phase of remedial selection is authorized by and consistent with the NCP provision at 40 C.F.R. 300.430(f)(5)(iii)(D) which provides that the ROD may:

> ...When appropriate, provide a commitment for further analysis and selection of long-term response measures within an appropriate time frame.

This operable unit ROD finalizes the interim provisions of the operable unit ROD that EPA issued for the Del Amo Waste Pits on September 5, 1997, as specified and described in detail in the Decision Summary. These provisions were designed to control the Waste Pits as a source of continuing contamination to groundwater.

Remedial Actions

Three areas of groundwater at the Joint Site are defined by convention in the Decision Summary of this ROD, as the ***chlorobenzene plume***, the ***benzene plume***, and the ***TCE plume***. This ROD establishes differing remedial requirements and objectives for each of these plumes, within the context of the overall remedial action, as discussed in the Decision Summary. The Decision Summary provides numerous details and additional specifications related to each of the following elements which are incorporated in this Declaration by reference. In addition, the Decision summary includes specifications for the monitoring and evaluation of the performance of the remedial action, for the chemical pCBSA, for actions to be taken during the course of the remedial action, and other specifications.

The remedy shall consist of the following actions and meet the following requirements, as further discussed and developed later in this ROD:

- Dissolved phase contamination in a specifically-bounded, monitored zone of groundwater, as defined in the Decision Summary, shall be contained and isolated indefinitely such that the contamination cannot escape the zone. This zone is referred to by this ROD as the ***containment zone***.[1] By containing the dissolved phase contamination surrounding the NAPL, this action isolates the NAPL from the remainder of groundwater.

- Specific ARARs shall be waived due to technical impracticability ("TI waiver"). The waived ARARs are identified in Appendix A of the ROD. The TI waiver of these ARARs shall apply solely to a zone of groundwater that is defined in the Decision Summary of this ROD and is referred to as the ***TI waiver zone***. The TI waiver zone and the containment zone are congruent and refer to the same physical space.

- Contaminants within the containment zone shall be contained by two methods: (1) groundwater extraction and treatment, and (2) monitored intrinsic biodegradation. The method which shall apply shall differ for various portions of groundwater, as specified and in accordance with all requirements and provisions in the Decision Summary.

- The concentrations of dissolved phase contaminants in all groundwater at the Joint Site that lies *outside* the containment zone shall be reduced to concentrations at or below standards identified and discussed in the Decision Summary of this ROD in a reasonable time frame. These standards are referred to by this ROD as ***in-situ groundwater standards,*** or ***ISGS***. This reduction shall be accomplished by extraction and treatment of groundwater. This requirement does not apply to the chemical pCBSA. Special actions for pCBSA are discussed in the Decision Summary.

- The reduction of the volume of water outside the containment zone that is contaminated at concentrations above ISGS levels shall be achieved at the groundwater extraction rates and in accordance with the performance standards, requirements, and provisions in the Decision Summary.

- The remedial action shall, while still meeting all other requirements and objectives of the remedial action as specified by this ROD, limit inducing adverse migration of NAPL (residual phase) contaminants. Additional definitions and exceptions with respect to this requirement are provided in the Decision Summary.

- The remedial action shall, while still meeting all other requirements and objectives of this

---

[1]The use of the term "containment zone" is this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

remedial action as specified by this ROD, limit the migration of existing contamination where such migration would be of a nature that would lengthen the remedial action, result in a greater potential health risk, or result in spreading of the contamination. Additional definitions and exceptions with respect to this requirement are provided in the Decision Summary.

- Any of several technologies (or combinations of those technologies), identified in the Decision Summary shall be considered acceptable for treatment as determined in the remedial design phase. This remedy shall attain all ARARs identified by this ROD that pertain to any of the technologies that are actually implemented.

- For the chlorobenzene and TCE plumes, groundwater shall be injected back into the aquifers after treatment to standards selected in this ROD. Additional specifications are provided in the Decision Summary.

- For the benzene plume, after treatment groundwater shall be discharged after treatment in one of the following ways as determined in the remedial design phase: (1) discharge to the storm sewer, (2) discharge to the sanitary sewer, or (3) aquifer injection. The discharge shall meet all ARARs identified in this ROD and any independently applicable standards for such discharges.

- Contingent actions, as put forth in the Decision Summary, shall be implemented in the event that the remedial action does not contain groundwater contamination within the containment zone.

- The hydraulics of the affected groundwater aquifers, the nature, extent, fate, and transport of contamination, and compliance with the requirements of this ROD, shall be continually monitored in accordance with the objectives, requirements and provisions presented in the Decision Summary.

- Existing drinking water production wells in the vicinity of the Joint Site shall be routinely monitored for the contaminants from the Joint Site and actions shall be taken to ensure that contamination from the Joint Site does not enter the potable water supply, as provided in the Decision Summary.

- Additional field data shall be acquired during the remedial design phase, including monitoring well data from new and existing monitoring wells, well surveys, aquifer tests, and other data as required and as specified in the Decision Summary.

- Institutional controls are identified in Sections 11 and 13 of the Decision Summary to reduce the potential for groundwater use in the area of contaminated groundwater

presently and during the course of the remedial action and to limit the potential for the spreading of existing contamination during the course of the remedial action.

5. Statutory Determinations

The selected remedy is protective of human health and the environment. In addition, as required by the terms of this ROD, EPA will conduct a second phase of remedial decisionmaking for this operable unit to address unresolved uncertainty regarding whether certain remedial actions selected in this ROD will continue to remain protective of human health and the environment over the long term. This second phase of remedial decisionmaking will address whether and to what degree NAPL recovery and/or NAPL immobilization shall occur at the Montrose Chemical and Del Amo Superfund Sites.

The selected remedy complies with Federal and State requirements that are legally applicable or relevant and appropriate (ARARs) to the remedial action, except where such ARARs have been waived. The waiver of certain ARARs, which are identified in Appendix B and explained in the Decision Summary of the ROD, is justified due to technical impracticability. This waiver applies to a specific zone of groundwater identified by the Decision Summary.

The selected remedy is cost effective and utilizes permanent solutions and alternative treatment technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces the mobility, toxicity, or volume as a principal element.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the remedial action, and again every five years subsequently for as long as hazardous substances remain on-site, to ensure that the remedy continues to provide adequate protection of public health or welfare or the environment. As part of these reviews, EPA shall evaluate toxicological studies which may have been performed since the issuance of this ROD to determine whether remedial actions selected in this ROD to address the groundwater contaminant pCBSA remain protective of human health and the environment. This discussed in detail in the Decision Summary of this ROD.

Keith Takata

Keith Takata, Director
Superfund Division
United States Environmental Protection Agency, Region IX

3-30-99
Date

II. DECISION SUMMARY

1. Site Names and Location

This record of decision (ROD) documents and establishes the dual-site operable unit remedy for groundwater at the Montrose Chemical and Del Amo Superfund Sites[1] (Figures 1-1 and 1-2) in Los Angeles, California (near the Cities of Torrance and Carson)(See Section 4 of this ROD for the context of this selected remedial action). The EPA CERCLIS identification numbers for these sites are CAD008242711 and CAD029544731, respectively. These separate, but adjacent Superfund sites have commingled groundwater contamination. Groundwater contamination at these two sites originated primarily from (1) the former Montrose Chemical plant and property, which manufactured the pesticide DDT between 1947 and 1982, and (2) the former Del Amo Synthetic Rubber plant and property, which operated between 1942 and 1972. There are other sources of groundwater contamination which are discussed in later sections of this ROD and in the remedial investigation reports. More details are provided in the Section 2 of this ROD, in the Remedial Investigation Reports, and Section 2 of the Joint Groundwater Feasibility Study.

The "Harbor Gateway" is a half-mile-wide strip of the City of Los Angeles that extends south from Los Angeles proper and provides the City a contiguous jurisdiction to Los Angeles Harbor. The former Montrose Chemical and Del Amo plants were located in the Harbor Gateway between the Cities of Torrance and Carson. The former Montrose plant property is at 20201 Normandie Avenue, lying on the west side of Normandie Avenue between Del Amo Boulevard on the south and Francisco Street (extended) on the north. The former Del Amo plant property lies in an area *roughly* bounded by Normandie Avenue on the west, Interstate 110 on the east, 190th Street on the north, and Del Amo boulevard on the south. The actual former plant property boundaries can be seen on Figure 1-2. The area surrounding the former plants contains portions of the cities of Carson, Gardena, and Torrance. A strip of land immediately east of the former Del Amo plant, and the residential area directly south of the former Del Amo plant, are part of unincorporated Los Angeles County. Overall, groundwater contamination associated with these two sites has

[1] On February 19, 1999, the United States Court of Appeals for the District of Columbia Circuit overturned EPA's final rule by which EPA had added the Del Amo Superfund Site to the Superfund National Priorities List. [Harbor Gateway Commercial Property Owners' Association, et al., v. U.S. EPA, 1999 U.S. App. LEXIS 2504 (D.C. Cir. 1999] Regardless of the NPL status of the Del Amo Site, it is appropriate to continue to refer to the Del Amo Site as the "Del Amo Superfund Site" because EPA, as the lead agency under the NCP, is continuing to undertake Superfund response actions at and with respect to that site, due to substantial actual or threatened releases of hazardous substances which pose an imminent and substantial endangerment to human health and the environment, and consistent with EPA's delegated CERCLA authority and the NCP [e.g., see 42 U.S.C. §9604(a-b); 40 C.F.R. §300.425(b)(4)].

come to be located over an area extending more than 1.3 miles in length, but its extent differs widely with the depth of the water-bearing unit as well as the lateral location being considered (see Section 7 of this ROD, Summary of Site Characteristics, for discussion of distribution of contamination and land use characteristics).

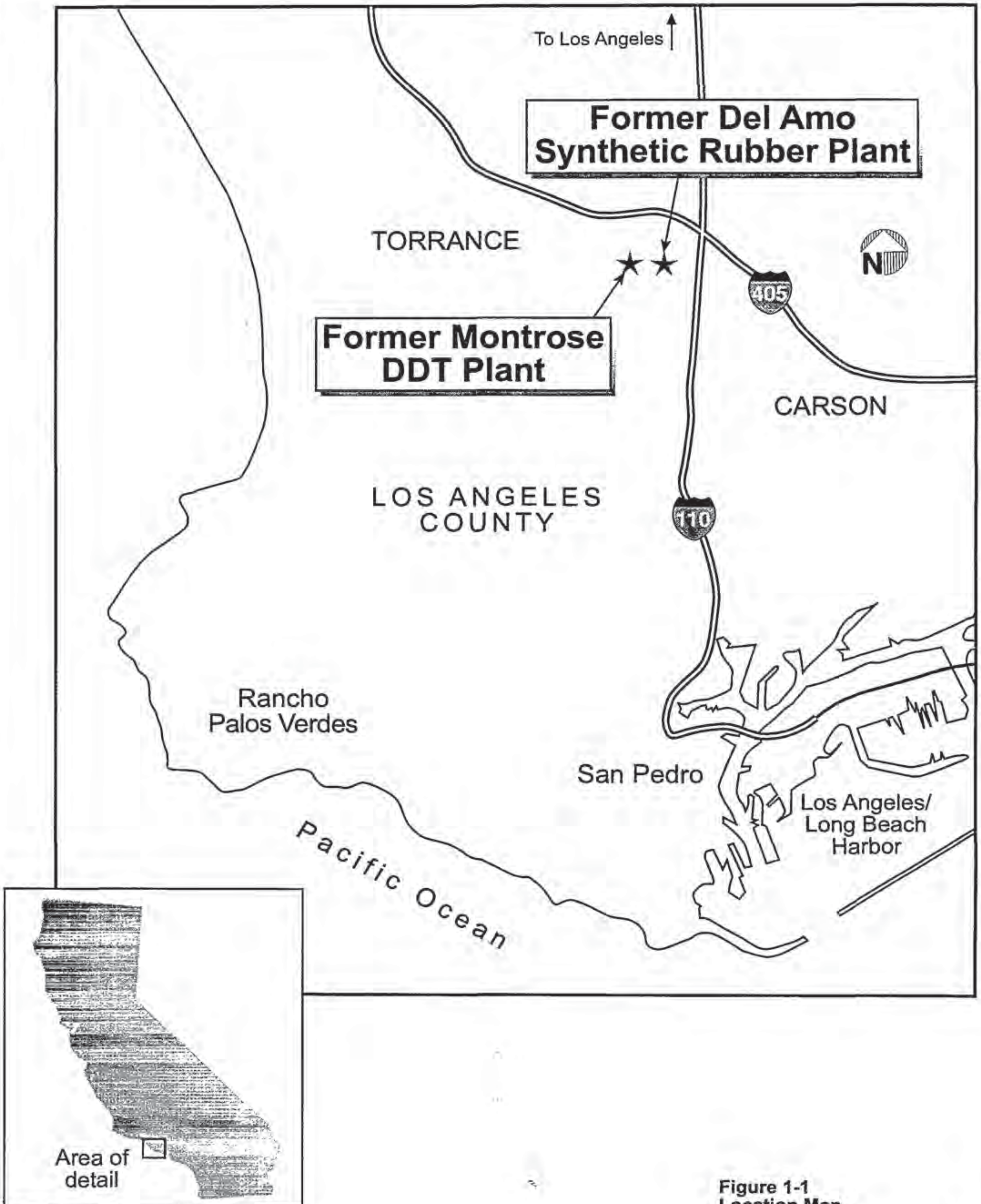


Figure 1-1
Location Map
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

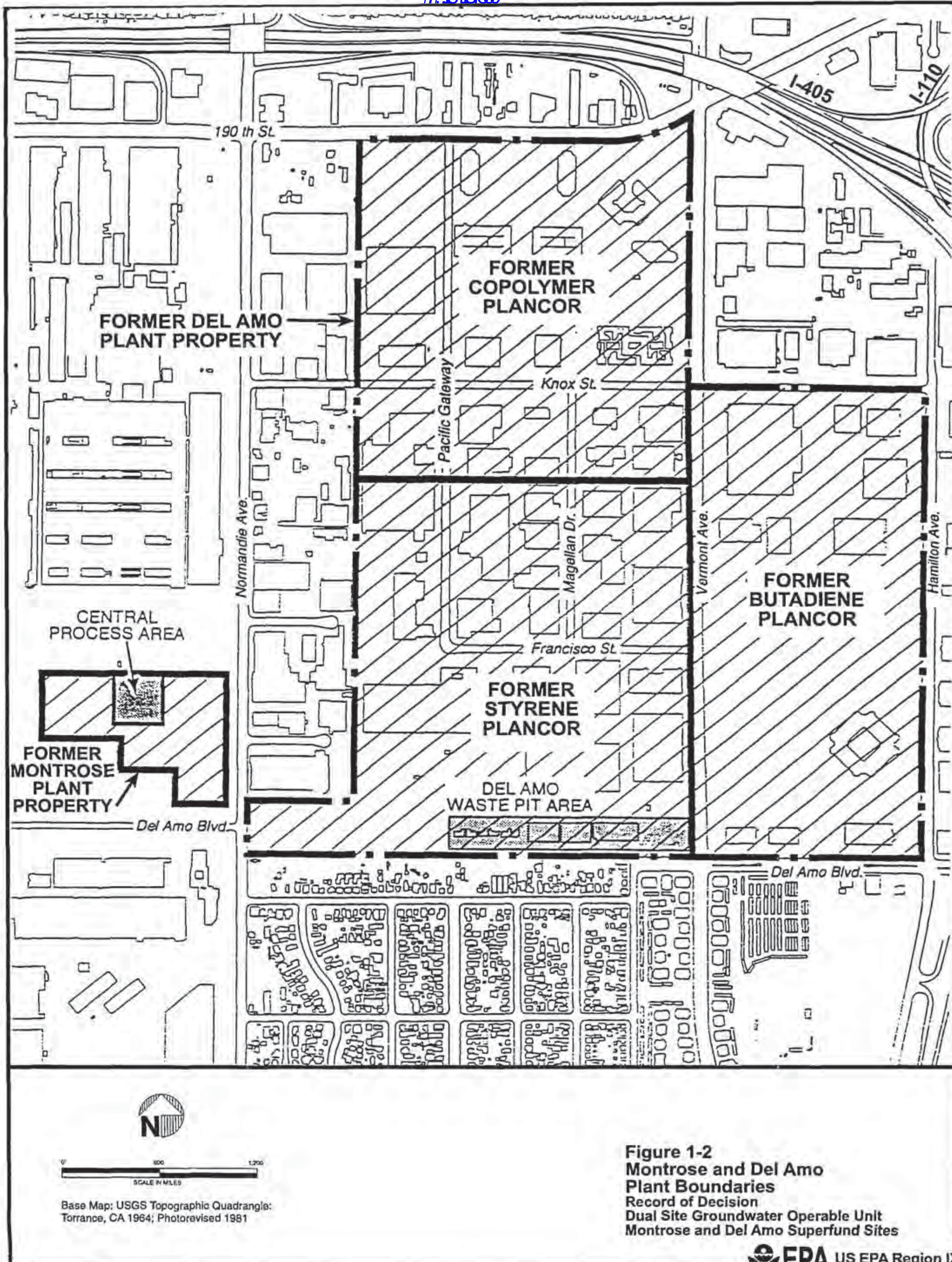


Figure 1-2
Montrose and Del Amo Plant Boundaries
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

2. Site History and Enforcement Activities

Figures 2-1, 2-2 and 2-3 show many of the features discussed in this text. Most major sources of contamination at the former Montrose and Del Amo plant properties, as well as minor sources between these major sources, are shown on Figure 2-3a. Areas of known or highly suspected non aqueous phase liquids (NAPL) are shown on Figure 2-3b. Section 2 of the JGWFS (1988), the Montrose Remedial Investigation Report (1988), and the Del Amo Groundwater Remedial Investigation Report (1988) each contain more detail on contaminant sources. See Section 7 of this ROD, Summary of Site Characteristics, for more details and conclusions about contaminant distributions.

2.1 Former Montrose Chemical Corporation Plant

Montrose Chemical Corporation operated a technical grade dichloro-diphenyltrichloroethane (DDT) pesticide manufacturing plant at 20201 S. Normandie Avenue in Los Angeles, California from 1947 to 1982. The 13-acre former plant property lies just outside the City of Torrance, in the Harbor Gateway (See Section 1 and Figures 1-1 and 1-2). Historical documents from the time of the plant's operations refer to the plant as "the Torrance plant," and the former plant property has a Torrance mailing address, despite the fact that it was not formally located within the boundaries of the City of Torrance. The layout of the former Montrose plant property is depicted in Figure 2-1.

DDT was one of the most-widely used pesticides in the world until 1972, when the use of DDT was banned in the United States for most purposes. After 1972, Montrose continued producing DDT at the former plant to be sold in other countries. In 1982-1983, the plant ceased operations, was dismantled, and all buildings were razed. Since 1985 there is a temporary asphalt covering over the former plant property, which is otherwise fenced and vacant.

During its 35 years of operation, the Montrose plant released hazardous substances, pollutants or contaminants, into the surrounding environment, including surface soils, surface drainage and storm water pathways, sanitary sewers, the Pacific Ocean, and groundwater. The primary raw materials Montrose used for making the pesticide DDT were ***monochlorobenzene*** (hereafter, "chlorobenzene") and ***trichloroacetaldehyde***, known as "chloral." Montrose placed these in batch reactors in the presence of a powerful sulfuric acid catalyst called oleum. The resulting chemical reaction produced DDT. Chlorobenzene and DDT are two of the primary contaminants found in the environment at the Montrose Chemical Site today. DDT does not significantly dissolve in water but will readily dissolve in chlorobenzene. When in its pure form, chlorobenzene is a dense non-aqueous phase liquid (DNAPL).

An unwanted by-product of DDT manufacture at the Montrose chemical plant was the highly water-soluble compound ***para-chlorobenzene sulfonic acid***, or pCBSA. This compound was created when chlorobenzene was directly sulfonated by sulfuric acid in Montrose's operations. To EPA's knowledge, pCBSA occurs in industry only in connection with DDT manufacture. There are no chronic toxicity data, and virtually no acute toxicity data for this compound. There are no promulgated health standards for pCBSA, which is found extensively in groundwater at the Montrose and Del Amo Superfund Sites. Additional information about pCBSA is provided in later sections of this ROD, including Section 8, Summary of Groundwater-Related Risks, and Section 12, Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative.

Montrose operations included a series of trenches used to convey wastes and a waste disposal pond (impoundment) which received wastewaters, DDT, and chlorobenzene. This pond also received caustic liquors and acid tars. Activities at the plant caused discharges of chemicals to the ground surface and to the waste pond. The soils under the Central Processing Area of the former Montrose plant contain large quantities of chlorobenzene in DNAPL form, as well as chlorobenzene dissolved in groundwater. The DNAPL occurs both above and below the water table. Data collected during the remedial investigation suggest that this DNAPL is a primary continuing source of groundwater contamination.

There were also periodic discharges of contamination from the Montrose plant into the storm water pathway leading from the Montrose plant. The evolution of this pathway and the discharges of wastes into it are described in detail in Chapter 1 of the *Remedial Investigation Report for the Montrose Superfund Site* (Montrose Site RI Report) (EPA, 1998). Some of these discharges may have resulted in standing contaminated water of significant quantity and over sufficient time that groundwater could have become newly or additionally contaminated by recharge from the ground surface.

Chapter 1 of the final Montrose Site RI Report gives additional details on the Montrose operating history. Section 7 of this ROD provides a more-detailed discussion of contaminant distribution; the most detailed description of contaminant distribution can be found in the Montrose Site RI Report, the Del Amo Groundwater RI Report (Dames & Moore, 1988), and the Joint Groundwater Feasibility Study (JGWFS), Section 2 (EPA, 1998). References for these documents are provided in Section 5 of this ROD.

2.2 Enforcement Activities Related to the Montrose Superfund Site

In 1982, EPA conducted an inspection of the Montrose property and determined that DDT was present in surface drainages leading from the Montrose property. In 1983, EPA and the California Regional Water Quality Control Board issued a enforcement orders to Montrose, requiring them to cease and desist their discharge of hazardous wastes to the storm drain and surface water drainages. On October 15, 1984, the Montrose Superfund Site was proposed for the National Priorities List, or NPL. The Site was listed final on the NPL on October 4, 1989. EPA began a remedial investigation of the Montrose Chemical Site under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA). Montrose demolished the former plant and graded the site in 1984 and 1985 without the prior approval of EPA. Montrose covered the entire property, except for an area in the southeastern corner, with an asphalt cap. On February 19, 1988, EPA issued a unilateral administrative order to Montrose requiring Montrose to cover the uncovered portion of the southeastern portion of the site with asphalt (EPA Docket No. 88-10). Montrose ultimately complied with this request.

On October 28, 1985, Montrose and EPA entered into an Administrative Order on Consent (AOC) (EPA Docket No. 85-04) which obligated Montrose to perform a remedial investigation and feasibility study (RI/FS) of the entire Montrose Chemical site. This AOC was subsequently amended twice, once in 1987 and again in 1989. The AOC required that Montrose evaluate the nature and extent of contamination at Montrose under EPA oversight and subject to EPA approval, including surface and deep soils at and surrounding the former plant site, surface soils in neighborhoods, groundwater, sanitary sewers, and surface water pathways. It also required that Montrose perform a feasibility study, subject to EPA oversight and approval, of alternatives for addressing the contaminants in all of these areas.

Montrose installed groundwater monitoring wells in four separate hydrostratigraphic units, installed onsite NAPL wells, drilled and sampled from soil borings on and near the former plant property, and performed a number of other investigation-related tasks. Montrose generated drafts of the remedial investigation report as well as several drafts of feasibility studies related to screening and evaluating alternatives for soils and groundwater. However, Montrose did not modify any of these drafts adequately, nor did Montrose address EPA's comments on these documents sufficiently, such that EPA could approve and finalize the RI or FS documents. In January 1998, pursuant to the provisions of the AOC, EPA took back from Montrose the work to complete the RI Report and EPA completed it using EPA staff and contractor resources.

See discussion below about the JGWFS for further information about enforcement activities after the initiation of the joint remedial effort for groundwater.

2.3 The Former Del Amo Synthetic Rubber Plant

The United States War Assets Administration (this former federal agency was succeeded by the U.S. General Services Administration [GSA]), owned a synthetic rubber manufacturing facility in Harbor Gateway, between the cities of Torrance and Carson, beginning in 1942. The War Assets Administration entered into operating agreements with Shell Oil Company (Shell), Dow Chemical Company, and several other companies, to operate the plant and to produce synthetic rubber for the United States during World War II. In 1955, Shell purchased the facility and began operating it directly. Shell operated the facility until 1972, at which time operations ceased, the plant was dismantled, and the plant buildings were razed. The plant property has been entirely redeveloped with light industrial and commercial enterprises, with the exception of the area at the south-central border of the former plant property, which is owned by Shell and is the location of the "Del Amo Waste Pits" (see below). The site did not take on the name "Del Amo" until later. The former Del Amo synthetic rubber plant property covered 270 acres, roughly 21 times the size of the neighboring Montrose plant property.

The layout of the former Del Amo plant property is depicted in Figure 2-2. The Del Amo plant had three sub-plants within it, commonly called "plancors." The styrene and butadiene plancors produced styrene and butadiene, respectively, and the rubber plancor chemically combined styrene and butadiene to make synthetic rubber. Of the three plancors, it has been shown that the majority of the contamination (there are exceptions) is found in the area of the former styrene plancor, in which large quantities of liquid benzene and ethylbenzene were stored and used. Over the years of its operation, the Del Amo plant released hazardous substances, pollutants, or contaminants into the surrounding environment. There are, at a minimum, eleven areas at the former Del Amo plant, nine of which are in the styrene plancor, which are under investigation as sources of benzene NAPL to the subsurface (See Figure 2-3a, Item Nos.2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12; and also Figure 2-3b). In some of these areas, the evidence of NAPL is conclusive because NAPL has been directly encountered. In the other areas, the evidence of NAPL presence is very strong, but based on deduction from indirect indicators. These areas remain under further investigation by Shell Oil Company and Dow Chemical Company under the oversight of EPA.

All of these NAPL sources lie within or close to the distribution, or "footprint", of the observed groundwater contamination. The "MW-20 area," so-named because it is near monitoring well MW-20, lies near a former benzene storage tank of at least a half-million gallons capacity (Item No.3 on Figure 2-3a; also shown on Figure 2-3b). South of MW-20 is a tank farm which stored benzene and ethylbenzene (Item No. 6 on Figure 2-3a; also shown on Figure 2-3b).

At the southern boundary of the former Del Amo plant property are the unlined "waste pits," in which both tarry and aqueous wastes were discharged, including wastes containing benzene, ethylbenzene, and naphthalene (Item No.10 on Figure 2-3a; also shown on Figure 2-3b). The

waste pits also received surfactants which may account for unusual contaminant migration patterns under the pits. While the pits have a thick soil cover, there is still 55,000 cubic yards of viscous waste remaining in the pits underground. In September 1997, EPA signed a ROD for an operable unit remedy for the waste pits. Pursuant to that selected remedy, an engineered impervious cap complying with requirements of the Resource, Conservation and Recovery Act (RCRA) will be constructed over the waste, which will be left in place. In addition, soil vapor extraction (SVE) will be performed on the soils under the waste. This remedial action is currently in the remedial design phase.

On the eastern end of the former rubber plant lies another area with extensive benzene contamination in soils and groundwater (Item No.12 on Figure 2-3a; also shown on Figure 2-3b). Plant history indicates the presence of laboratories, above-ground pipelines, chemical storage and processing areas, and wastewater treatment areas. All of these have been the subject of the Superfund remedial investigation effort, and some remain under investigation. Enough information is known, however, to select the remedial actions set out in the ROD for groundwater.

In the southeastern area of the former Del Amo plant site, directly east of the waste pits, is another area with confirmed benzene NAPL contamination (Item No.11 on Figure 2-3a; also shown on Figure 2-3b). The source of this benzene is not immediately apparent, though there was a major pipeline in this area while the plant was in operation.

2.4 Enforcement Activities Related to the Del Amo Superfund Site

On May 7, 1992, EPA, Shell Oil Company (Shell), and Dow Chemical Corporation (Dow) entered into an Administrative Order on Consent (AOC) (EPA Docket No. 92-13) which required Shell and Dow, acting as "the Del Amo Respondents," to perform a remedial investigation and feasibility study for the Del Amo site, including the entire 270-acre former plant site. Among the requirements of this AOC was that the Del Amo Respondents perform a 2-phase remedial investigation, a feasibility study, and several focused investigations, including the NAPL near well MW-20, as well as a focused investigation/feasibility study for the Del Amo Waste Pits. To date the Del Amo Respondents have produced a draft Phase I remedial investigation report, a final groundwater remedial investigation report (see below), a final focused feasibility study for the waste pits area, a series of reports and documents related to its investigation of the NAPL at MW-20 and a pilot NAPL hydraulic extraction test (treatability study) for that area, a report on NAPL near monitoring well P-1 and the transmission pipelines, and numerous other satellite documents. The Phase 1 RI report was never finalized by the Respondents, with the agreement that EPA's comments on that document would be addressed in the final RI and that the draft Phase I RI would not be referenced. Phase II work is now in progress.

When the joint groundwater work was initiated, EPA acknowledged that a separate remedial investigation report would be needed for the Del Amo Site which addressed groundwater only, while all remaining aspects of the remedial investigation would need to be documented in a separate report which would be issued later. The Del Amo Respondents voluntarily agreed to produce a "Del Amo Groundwater Remedial Investigation Report," which was completed to EPA's satisfaction in May of 1998.

2.5 Enforcement History Related to the Joint Groundwater Remedial Effort

Because the investigation of the Montrose Chemical Site had begun earlier than that for the Del Amo Site, originally there had been insufficient data to determine (1) the degree to which groundwater contamination from the Montrose and Del Amo Sites were commingled, and (2) the degree to which contamination from the Montrose Chemical Site might be affected by remedial actions that were being considered in feasibility studies for groundwater at the Montrose Chemical Site. The Montrose remedial investigation had identified the existence of extensive Del Amo-related groundwater contamination, but initially the remedial investigation at the Del Amo Site had not progressed to the point that this contamination was adequately defined. Accordingly, EPA considered selecting limited interim groundwater remedies for the Montrose Chemical Site until these factors could be resolved.

However, by late 1995, sufficient data had been obtained from the Del Amo groundwater investigation to determine that (1) the groundwater contamination from the two sites was commingled, and (2) the evaluation of remedial alternatives related to groundwater contamination at one site was inseparable from the same evaluation at the other site. Groundwater contamination at both sites had to be considered together in order to properly evaluate and select groundwater alternatives for the two sites (See Section 4, Context, Scope and Role of the Remedial action, in this ROD).

In late 1995 and early 1996, EPA informed and opened a dialogue with Montrose Chemical and the Del Amo Respondents (Shell Oil Company and Dow Chemical Company) that EPA intended to unite the remedial selection processes with respect to groundwater, thereby leading to a single feasibility study and a dual-site groundwater ROD. EPA initiated a process to generate a single feasibility study, called a Joint Groundwater Feasibility Study (JGWFS) to provide analysis for this ROD. While the separate AOC documents did not directly discuss a JGWFS, the parties agreed to proceed with the joint work as envisioned by EPA on a voluntary basis.

In March of 1996, a joint groundwater modeling effort was initiated. This technical effort was intensely overseen by EPA and was carried out by technical consultants to both parties. A series of meetings occurred from one to three times per month for six months in which a sophisticated

groundwater flow and contaminant transport model was developed. The model was run and results compiled in late 1996. Summary details, results, and limitations of this model are discussed in a later section of this document. Those wishing technical or complete detail are referred to the Joint Groundwater Feasibility Study (EPA, 1998).

While the draft JGWFS was due on March 10, 1997, the joint parties did not submit the draft document to EPA until May 20, 1997. Upon reviewing this document, EPA found it highly deficient and misleading in numerous respects (*See* A.R. No. 4742; EPA DCN 0639-03730). EPA formally took over the work to complete the JGWFS on August 14, 1997. EPA found that while the modeling effort was technically sound and usable, the draft JGWFS report required wholesale revision. EPA took over the work and rewrote the JGWFS, and released the public comment draft on June 26, 1998. The JGWFS is considered final with the issuance of this ROD.

In January, 1998, EPA took over the effort to complete the Montrose Site RI Report after Montrose did not produce an acceptable draft after almost a decade of multiple iterations of Montrose drafts and comments by EPA. EPA completed its revision to this draft document on June 26, 1998. This was referred to as the "Public Comment Draft."

The Del Amo Respondents completed the Groundwater Remedial Investigation Report pertaining to the Del Amo Site on May 18, 1998, in accordance with EPA's comments and EPA has approved that document.

Both Montrose Chemical and the Del Amo Respondents completed the *Joint Groundwater Risk Assessment* in accordance with EPA comments in February, 1998. This document was approved by EPA as amended by EPA's *Supplement to Joint Groundwater Risk Assessment* (EPA, 1988).

2.6 Contaminant Sources Other Than the Montrose Chemical and Del Amo Plants

Within the Joint Site (See Section 6 for formal definition of Joint Site), there are several actual or potential sources of benzene and chlorinated solvents in addition to the former Montrose Chemical plant and former Del Amo plant. Montrose Chemical is the only known source of chlorobenzene, DDT, and pCBSA to groundwater at the Joint Site. As part of the Joint Site, these sources are by definition either entirely within the current area of groundwater contamination from the Montrose Chemical and Del Amo Sites, partly within it, or sufficiently close that contamination will have to be addressed as part of the remedial action selected in this ROD (See Section 6 of this ROD for definition of the term, "Joint Site."). *This section is intended for the purposes of providing background and does not necessarily identify all such sources.* The sources are listed below with the likely primary contributing contaminant in parentheses (). Other contaminants may also be present in each case, as identified by Section 7 of

this ROD and the remedial investigation reports for this remedial action, as referenced in Section 5 of this ROD.

- **Petroleum transmission pipelines (benzene).** A series of petroleum transmission pipelines, unrelated to the former Montrose and Del Amo plants, have been and still are used to transfer petroleum products from the port to the refineries in the area (Figure 2-3a, Items "K," "M," and "N"). There are several locations directly under these pipelines where groundwater concentrations are indicative of the likely presence of benzene NAPL and which may be related to these pipelines. The pipelines occur in separate bundles. Most of these bundles run in an east-west direction just south of both the former Montrose Chemical and Del Amo plant properties. One suspect location along this pipeline is south of Montrose along the pipeline, and east of the Jones Chemicals facility (See below for discussion of Jones). Another bundle is a feeder line that runs in a north-south direction into the east-west transmission line, parallel to Berendo Avenue south of the former Del Amo plant. Petroleum NAPL containing benzene has been directly observed along this feeder line near historical groundwater monitoring well P-1.

- **Stauffer Chemical (benzene).** A potential source of benzene in groundwater near the former Montrose plant is Stauffer Chemical, which historically operated a chemical plant on the Montrose property that manufactured benzene hexachloride (BHC), another pesticide. BHC manufacture requires benzene as a feedstock. In the process, benzene is chlorinated to form BHC. The gamma isomer of BHC is known as lindane.

- **Montrose (benzene).** A potential source of benzene in groundwater near the former Montrose plant is the benzene that occurred in raw chlorobenzene, most likely at a rate of less than 1%. Because of the copious quantities of chlorobenzene released, this could account for some of the benzene contamination in groundwater.

- **The Jones Chemicals, Inc. plant (TCE, PCE, DCE, and benzene).** This plant manufactures bleach and sells other chemical products in bulk and has been in operation immediately south of the former Montrose plant since the mid-1950s (Items "J" and "L" on Figure 2-3a). Based on investigations by EPA and the State of California, Jones Chemicals, Inc. is known to have discharged chlorinated solvents to a dry well on their property. Likewise, there are fuel tanks which may have leaked petroleum products into the subsurface. Jones also stored PCE on its property in bulk, packaged PCE in drums, and sold PCE for a number of years. Jones also operated a drum washing facility which was also a likely source of chlorinated aliphatic solvents released to the subsurface.

- **Solvent-handling Facilities (TCE, PCE)** There are facilities near 196th Street at the western border of the former Del Amo plant which have handled chlorinated solvents and

have soils with significant concentrations of these solvents (Item No. 2 on Figure 2-3a; also shown on Figure 2-3b). The operations at these facilities occurred or continue to occur subsequent to the closure of the Del Amo plant.

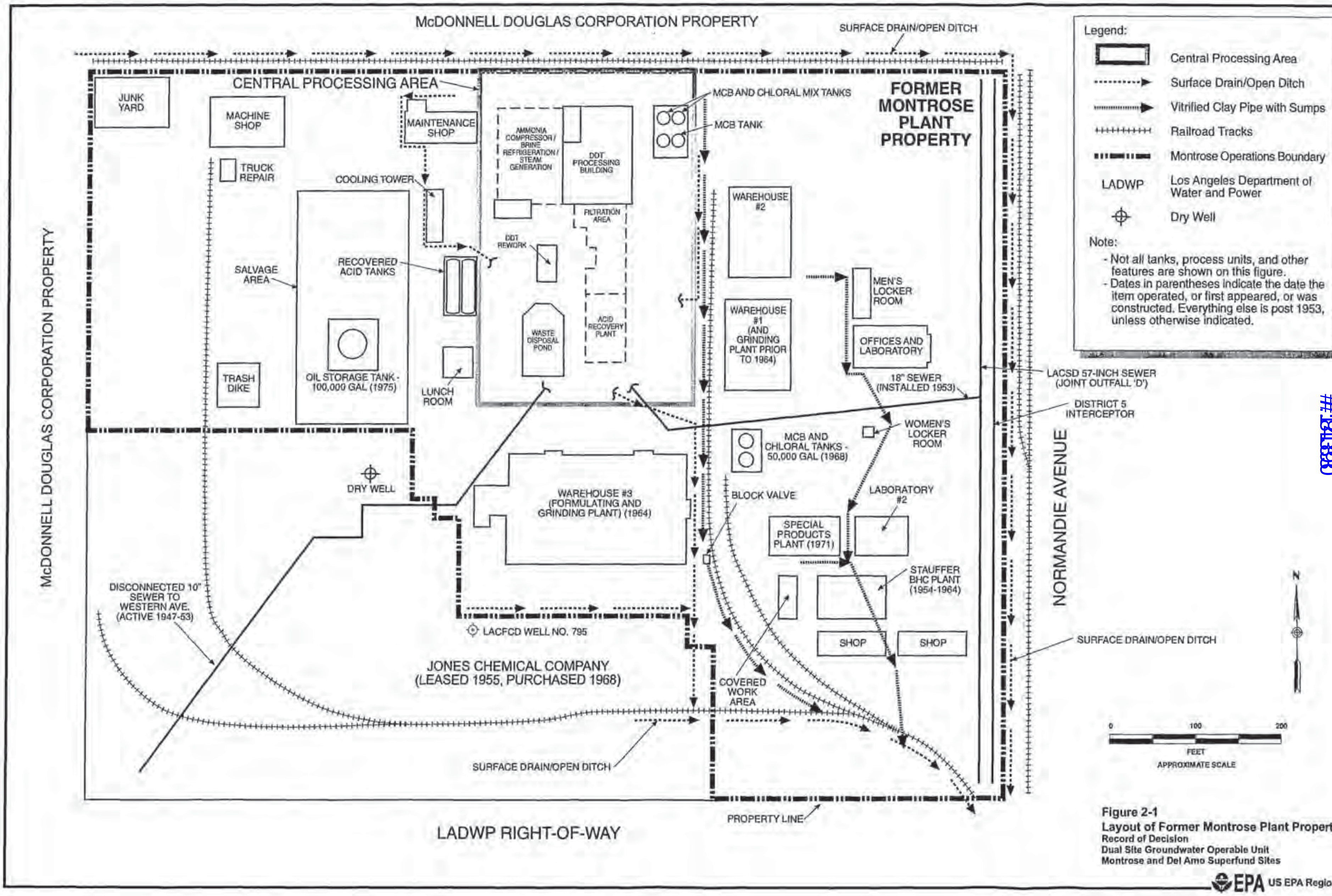


Figure 2-1
Layout of Former Montrose Plant Property
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

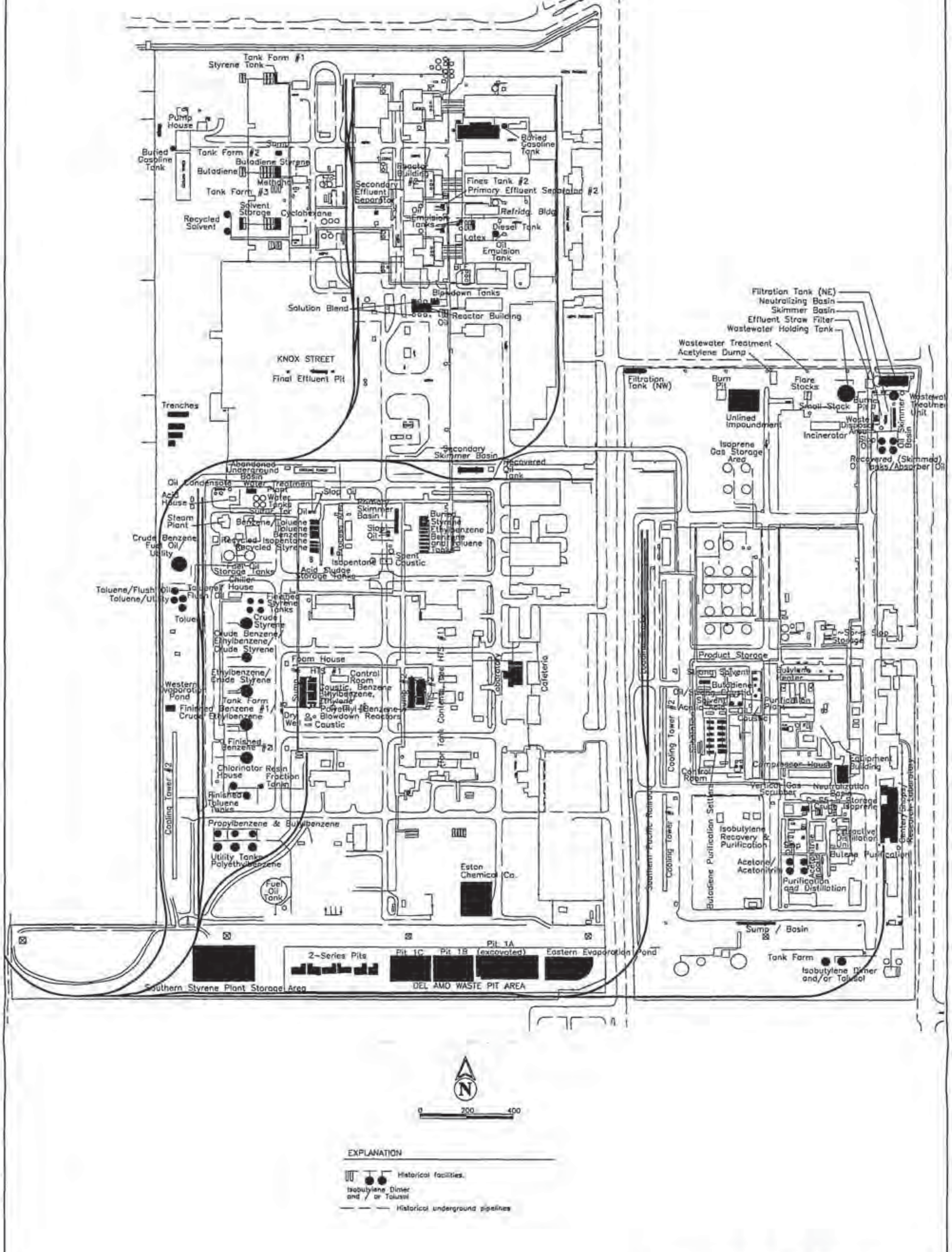


Figure 2-2

Historical Facilities
for Former Del Amo Plant Property
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

N

0 600 1200

EXPLANATION

⑨ Approximate location of groundwater contamination source areas

Source Area Number	Suspected Former Source Facility	VOCs with Elevated Concentrations in Groundwater
1	Former Del Amo Plant Property cyclohexane tanks	cyclohexane
2	Former Del Amo Plant Property pits and trenches and/or solvent facility	TCE PCE chloroform
3	Former Del Amo Plant Property XMW-20 LNAPL (benzene tank and/or pipeline)	benzene (LNAPL) toluene ethylbenzene
4	Former Del Amo Plant Property VOC tanks in styrene finishing/benzene purification unit	benzene ethylbenzene cyclohexane
5	Former Del Amo Plant Property VOC tanks and/or underground pipelines in styrene finishing unit	BTEX styrene naphthalene
6	Former Del Amo Plant Property tank farm (VOC storage)	benzene ethylbenzene
7	Former Del Amo Plant Property VOC storage tanks at ethylbenzene production unit #1	benzene ethylbenzene
8	Former Del Amo Plant Property VOC storage tanks at ethylbenzene production unit #2	benzene ethylbenzene phenol
9	Former Del Amo Plant Property "utility tanks"	benzene toluene
10	Former Del Amo Plant Property Waste Pit Area and underground petroleum product pipelines	BTEX naphthalene phenol
11	Former Del Amo Plant Property underground benzene pipeline	benzene phenol(?)
12	Former Del Amo Plant Property laboratory, underground pipelines (?)	BTEX styrene cyclohexane naphthalene
13	Former Montrose Plant Property (DNAPL) central process area	chlorobenzene (DNAPL) benzene
N	Pipelines	benzene naphthalene
K	Pipelines	BTEX 1,1-DCA
J, L	Jones Chemical	TCE, PCE, 1,1-DCE, 1,1-DCA, benzene
M	SBL102 LNAPL	petroleum hydrocarbons

FIGURE 2-3a

Former Montrose and Del Amo Plant Properties Groundwater Contamination Source Areas

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

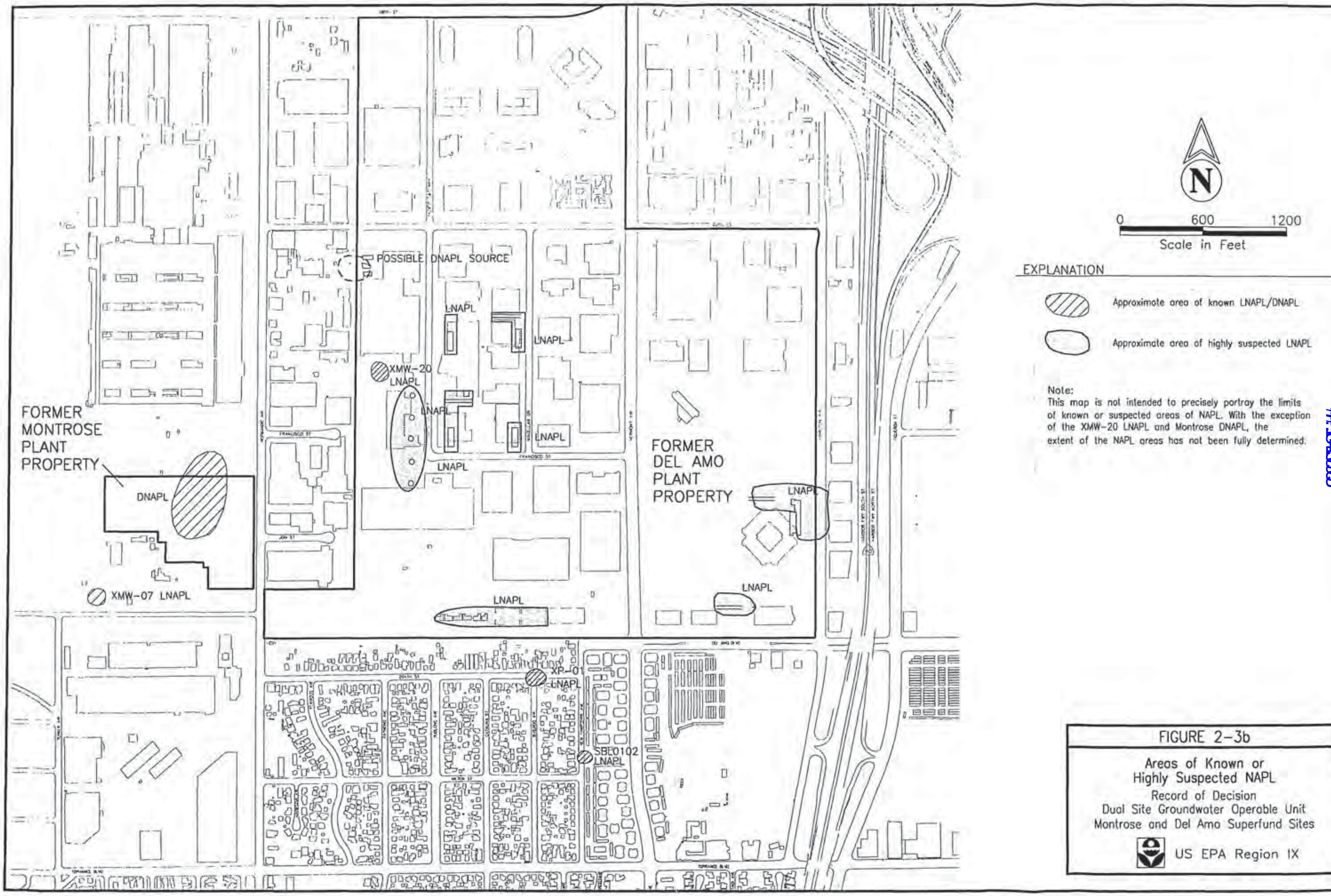


FIGURE 2-3b

Areas of Known or
Highly Suspected NAPL
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

3. Highlights of Community Involvement Activities

3.1 Communities and General Community Involvement

A community relations plan was developed and issued by EPA in July of 1985 (EPA DCN 0639-00482). EPA issued an updated community relations plan in November of 1996 (EPA DCN 0639-02277). These plans were issued in accordance with EPA guidance to facilitate the Community involvement with respect to all Superfund actions for the Montrose Chemical and Del Amo Sites. This plan has been followed by EPA with respect to general community involvement as work at the two sites has proceeded over more than a decade.

EPA has maintained a mailing list database, which is updated on a continuous basis, and has issued fact sheets to persons and business entities on this mailing list throughout the Superfund project, which began for the Montrose Chemical Superfund site in 1983 and for the Del Amo Superfund site in 1991. As discussed earlier in this ROD, there are many aspects of the Montrose Chemical and Del Amo Superfund sites which are undergoing separate investigation and cleanup actions; groundwater is one of these actions and is being addressed in a dual-site manner. Beginning in 1983 and onward, EPA issued fact sheets to the mailing list and to any parties interested in the Superfund sites, addressing either some or all of the various actions and investigations underway. Groundwater was among these actions and investigations. These fact sheets provided the public with historical and up-to-date data and information about the sites and EPA's approach to the sites. They also encouraged the public to approach EPA with any concerns and comments they may have, and gave an opportunity to add or remove names from the mailing list.

During the period 1983 to 1993, community interest in these sites was modest. In 1993, fill material contaminated with DDT was found in residential yards along 204th Street, which were immediately adjacent to the former Del Amo waste pits. A community group, the Del Amo Action Committee, was formed at that time. Over time, this group took up the broader issues of health concerns and possible contamination throughout the wider neighborhood. Other groups and individuals with other interests and positions also existed in the community near the Montrose Chemical and Del Amo sites. Beginning in 1994, to address issues associated with the temporary relocation of some neighborhood residents and other concerns in the neighborhood, EPA substantially increased its community relations effort, including meetings and workshops monthly and as often as weekly, numerous fact sheets, special hot-lines, and media relations.

Although a majority of community involvement since 1994 has been focused on actions related to neighborhoods and neighborhood soils, EPA often "piggybacked" on these efforts (meetings, fact

sheets, etc.) to provide the community with reports on progress, data, and changes in approach with respect to the groundwater investigation and feasibility study.

In 1997, members of the community, the Del Amo Action Committee, the EPA, agencies of the State of California, and many local agencies, formed a group called the Montrose and Del Amo Neighborhood Partners, which now meets regularly. EPA provides information to this group on groundwater and has received feedback on concerns related to groundwater.

3.2 Information Repository

EPA has maintained an information repository at the Torrance and Carson public libraries with hard copies of selected critical documents related to the investigation and response actions for the Montrose Chemical Superfund site and the Del Amo Superfund site. This repository contains the administrative record for the remedial action selected by this ROD.

3.3 Community Involvement Activities Specific to the Proposed Plan for the Groundwater Remedial Action Selected by this ROD

On April 17, 1997, EPA held an informational workshop about groundwater geared to the segment of the community without substantial scientific background. EPA advertised the meeting via a flyer sent out on our mailing list. The EPA remedial project manager (RPM) and community involvement coordinator (CIC) used a computer-generated slide show, various demonstration aids, and a groundwater model as visual aids to explain: (1) the nature and operational history of the sites, (2) what groundwater is and how water moves in aquifers and aquitards, (3) the extent of contamination in each aquifer at the Joint Site[1], (4) what non-aqueous phase liquids are and how they behave, (5) why some of the groundwater cannot be cleaned up fully, (6) the approach of using a NAPL isolation zone and restoring groundwater outside that zone, (7) the concept of intrinsic biodegradation, (8) the concept of groundwater pumping for containment or for full cleanup, and (9) some possible types of generalized actions EPA might take to address the groundwater. This meeting took place prior to the release of the Joint Groundwater Feasibility Study and was designed to be a primer to help people understand the proposed plan when it was issued. Approximately 50 people attended. EPA answered questions of the community during this workshop and fielded concerns to take back into the remedy development process.

In May 1998, the CIC approached both the Del Amo & Montrose Partnership as well as the Del Amo Land Use Community Advisory Panel and offered to provide them with additional

[1]See Section 6 for formal definition of Joint Site.

workshops or briefings on EPA's proposed groundwater remedy prior to the Dual Site Proposed Plan Public Meeting. Neither group accepted our offer, preferring to participate at the public meeting instead.

On June 26, 1998, EPA released two versions of the *Proposed Plan; Dual Site Groundwater Operable Unit, Montrose and Del Amo Superfund Sites.* Both versions of the plan were made available in English and Spanish. One version, the general fact sheet version, was less technical and was targeted primarily at the average person. The technical and expanded version was more technical in its terminology and analysis, was much longer, and was aimed primarily at the technical community. Each version was written to serve as a stand-alone document. Any person could receive either or both versions, in either language, upon request. The following activities accompanied this release:

- The general fact sheet version was sent to the mailing list of approximately 1900 individuals, and informed them about how to receive a copy of the technical and expanded version of the proposed plan if desired;
- The general fact sheet version was made available to anyone else who requested a copy;
- The general fact sheet version was posted on the Del Amo/Montrose web site; (URL: http://www.epa.gov/region09/waste)
- The technical and expanded version was sent to the Montrose/Del Amo Neighborhood Partners, potentially responsible parties, their attorneys and representatives, and anyone who requested a copy;
- The availability of the fact sheet and the administrative record file, and the commencement date and duration of the public comment period, were published in a local newspaper announcement; and
- A press release was issued announcing EPA's proposal, the availability of the proposed plan and administrative record file, and the commencement and duration of the public comment period.

On July 1, 1998, the administrative record file for the Dual Site Groundwater Operable Unit was made available in the Torrance and Carson public libraries, on microfilm. Selected critical documents, including the remedial investigation reports, the Joint Groundwater Feasibility Study (JGWFS), the Joint Groundwater Risk Assessment, and EPA's supplement to the risk assessment were made available in hard copy in the libraries.

On July 2, 1998, EPA opened a formal public comment period on the proposed plan and administrative record file. The original notice provided that the comment period would have a duration of 30 days and close on July 31, 1998. Subsequently, in response to requests by members of the public, EPA extended the public comment period by an additional 30 days, to August 30, 1998. An announcement of this change was placed in the same local newspaper which carried the original announcement. The public comment period spanned a total of 60 days. Because August 30 fell on a Sunday, EPA considered comments that were received or postmarked on or before Monday, August 31, 1998.

A formal public meeting on EPA's proposed plan and administrative record file was held during the afternoon on Saturday, July 25, 1998 at the Torrance Holiday Inn on Vermont Street. EPA presented an in-depth presentation about groundwater and EPA's proposal, using computer graphics and slides, and a highly sophisticated model with dye representing contaminants under the ground. EPA summarized the problems posed by the two sites. The information provided in the April 17, 1997 workshop was largely repeated and expanded upon. EPA answered the public's questions during and after this presentation. The EPA presentation was followed by a formal comment period. Both EPA's presentation, the questions and answers, and the formal comment period were transcribed by a court reporter. Approximately 35 people attended, including representatives of Del Amo Action Committee, the Del Amo Land Community Advisory Panel, local businesses, and other members of the general public. Comments read into the record during the formal comment portion of the public meeting were addressed by EPA prior to issuance of this ROD. EPA's responses can be found in the response summary.

4. Context, Scope and Role of the Remedial Action

This operable unit remedy addresses cleanup of contaminated groundwater and the containment of dissolved phase contamination surrounding non-aqueous phase liquids (NAPL), with respect to *both* the Montrose Chemical and the Del Amo Superfund Sites.[1] EPA refers to this action as a ***dual-site operable unit remedy***. The term "dual site" refers to its application to two Superfund sites within a single ROD. As an operable unit remedy, this remedy addresses only a specific portion of all contamination at the Montrose Chemical and Del Amo Superfund Sites. Overall site remedies will, and other operable unit remedies may, be selected for each of the sites. Subsequent amendments to this ROD may be on either a dual-site or site-specific basis, as determined appropriate by EPA.

This ROD establishes remedial actions and standards that differ among various areas of groundwater within the Montrose and Del Amo Sites. The ROD defines these areas both laterally and with depth (i.e. 3-dimensionally) within the system of hydrostratigraphic units present at the Joint Site[2]. This is because (1) the nature and extent of NAPL contamination has made it necessary to address contaminated groundwater that is near NAPL differently than contaminated groundwater at a greater distance from NAPL, and (2) there are physical differences among the various areas of dissolved phase contamination within the overall contaminant distribution that justify differing goals and actions. The details of these distinctions are summarized later in this ROD.

This ROD contains multiple specialized issues and approaches which require substantial discussion. As just mentioned, the ROD utilizes a dual-site approach, and selects differing actions for multiple areas of groundwater. In addition, this ROD 1) reflects only the first of two phases of remedy decisionmaking with respect to this operable unit, 2) includes a waiver of certain applicable or relevant and appropriate requirements based on technical impracticability for a defined area of groundwater, and 3) relies on more than one general response action (both intrinsic biodegradation, a form of natural attenuation, as well as hydraulic extraction and treatment) to meet remedial objectives. This section places these factors and the remedial approach being used into context so as to define the scope of the remedial action clearly and provide a contextual backdrop for the other sections of this document.

---

[1]Groundwater at the Montrose Chemical and Del Amo Sites is contaminated by hazardous substances and other pollutants or contaminants as defined by Section 101 of CERCLA, 42 U.S.C. §9601, and/or listed by EPA as CERCLA hazardous substances in 40 C.F.R. Table 302.4. *See also* 40 C.F.R. §302.4.

[2]See Section 6 for formal definition of the term "Joint Site."

4.1 Dual-Site Basis and Approach

The groundwater contamination from the Montrose Chemical and Del Amo Superfund Sites has partially commingled, or merged. Originally, EPA oversaw separate remedial investigations and feasibility studies for groundwater at the two sites. However, EPA has found that factors and considerations related to evaluation of remedial alternatives and implementation of remedial actions for groundwater at these sites is inextricably related. Remedial actions taken for groundwater at one site will, to some extent, affect remedial actions taken at the other site, either by affecting the type of action taken or the manner in which the action is implemented, or both.

The groundwater contamination at these two sites presents as one interrelated technical problem. This is not to say that there are not technical distinctions worth identifying and considering between the Montrose and Del Amo Sites with respect to groundwater contamination and these have been considered by EPA, as appropriate. However, it is appropriate to frame a single remedy selection process for groundwater at the two sites. The nature and extent of contamination and the nature of the EPA Superfund remedy selection process lead to the following conclusions:

1. The implications of possible remedial actions for one site must be viewed in the context of those being considered for the other site;

2. The remedial actions for both sites must be mutually consistent; and

3. The nine remedy selection criteria in the National Contingency Plan (NCP) must not be evaluated in terms of either site alone, but in relation to the groundwater contamination from both sites as a whole.

As an example, a principal goal of the JGWFS was to evaluate the degree to which groundwater contamination at either site may be adversely moved by remedial actions being considered for the groundwater contamination at the other site. Likewise, consideration was given to whether taking certain actions for one site might affect the range or latitude of options for, or the efficacy of, addressing the other site. Such factors had to be considered together, both in time and within a single vehicle.

As another example, objectives strongly valued at one site, such as cleaning up more quickly and/or keeping existing contamination contained, bring about consideration of actions at the other site, or make some results at the other site more acceptable than they would otherwise be when considered alone. A balancing among the "site-specific" objectives is required.

Attempts to separate evaluations of remedial alternatives independently "by site" would have become artificial and awkward. The likely result of such an effort would have been two largely redundant and duplicative remedy selection processes, each with a set of reports straining to confine its evaluation of criteria within the sphere relating to one site, when the considerations needed cross site boundaries and pertain to the interrelated dual site. Such an approach also would have presented the formidable administrative risk of being either technically or administratively inconsistent and making the remedy selection process muddled or incomprehensible to the public.

Accordingly, EPA has employed a unified process of evaluation, public comment, and remedy selection to apply to this groundwater operable unit at both sites. Using a unified approach has: (1) provided for technical consistency and completeness, (2) minimized and simplified the administrative process of remedy selection, and (3) facilitated public understanding and the ability of the public to comment on the remedy when it was proposed to the public.

4.2 Site-Wide Context of This Operable Unit

Table 4-1 shows the contaminated media affected by each of the Superfund sites. The operable unit remedy selected in this ROD addresses only groundwater and NAPL, the first two items under each site in Table 4-1. EPA is conducting separate investigations and planning separate remedy selection processes for the other affected media at these sites, as shown in Table 4-1. The other affected media, and the activities being undertaken to address them, are not covered by this document or this remedy. The interim provisions of an operable unit ROD for the Del Amo Waste Pits, issued September 5, 1997, are finalized by this ROD.

4.3 The Problem Posed by NAPL at the Joint Site

The presence of NAPL contamination at both the Montrose and Del Amo sites strongly influences (1) the nature and scope of this remedy, (2) the remedial approach used in all remedial alternatives considered, and (3) the evaluation of alternatives. While more information is provided on NAPL and its distribution in later sections, a discussion is provided here to establish how NAPL relates to these contextual aspects.

At most sites where it occurs, contamination in groundwater is present in one of three forms: (1) dissolved in the water, called *the dissolved phase*; (2) adsorbed to soil particles, called *the sorbed phase*; and (3) as non aqueous phase liquid, called the *residual phase* or *NAPL phase*. Contaminant mass can be transferred among these three phases as subsurface conditions change. Generally speaking, NAPL is the presence of the pure, undissolved form of a chemical which is a liquid at standard temperature and pressure and which has a low enough water solubility that it is significantly immiscible with water and can exist as a separate phase when present in water. The

term "NAPL" does not refer to the chemical content of a substance but rather to its form. Many chemicals and mixtures of chemicals display NAPL properties but their chemical composition can only be resolved with site-specific sampling and analysis.

NAPL is usually associated with one or more of the following characteristics: (1) high interfacial tension with the water phase; (2) a density difference with the water phase; (3) movement that is dominated more by the relative saturations of NAPL/water/air, buoyancy forces, gravity and capillary pressures, rather than by hydraulic gradients, and (4) heightened viscosity. However, it is important to note that there are many chemicals for which the NAPL form is not highly viscous. An example of this is chlorinated aliphatic solvents. NAPL that has density less than the density of water is called "light non-aqueous phase liquid," or "LNAPL," and NAPL with density greater than that of water is called "dense non-aqueous phase liquid," or "DNAPL."

EPA's experience at Superfund sites is that NAPL often creates serious challenges for remedial efforts. This is because, on the one hand, it dissolves into groundwater and causes high concentrations of contaminants (up to the solubility limit) in groundwater; yet, on the other hand, complete dissolution of NAPL takes a very long period of time, and it cannot be easily flushed and removed from the aquifer. It can be exceedingly difficult to determine with a significant or reasonable degree of certainty: (1) the location of NAPL at a site, (2) the distribution of NAPL, (3) the total NAPL mass, and (4) the lowest elevation in the subsurface at which NAPL occurs ("bottom of the NAPL-contaminated zone"). NAPL can remain in the soils indefinitely, either above or below the water table, where it continually dissolves, either directly into groundwater, or into soil moisture which percolates into groundwater. In this way, NAPL represents a continuing and often recalcitrant source of dissolved phase contaminants into groundwater. Once in groundwater, the movement of the dissolved contaminants is controlled by the processes of advection, dispersion, retardation, and degradation. Figure 4-1 provides a simple depiction of this process. In order to clean groundwater when a NAPL source is present, the NAPL must either be removed, destroyed, or isolated; otherwise, continuing dissolution from the NAPL will re-contaminate groundwater which has been cleaned.

NAPL is present in many areas in the subsurface at the Montrose and Del Amo Sites, surrounded by larger areas of dissolved-phase contamination in groundwater. At these sites, NAPL is present under conditions such that it is technically impracticable with existing technologies to remove enough NAPL to reduce groundwater concentrations to health-based standards at all points in the groundwater plume. Attaining groundwater standards in the midst of the NAPL-impacted areas would require virtually complete elimination of the NAPL from the ground, which EPA has determined to be technically impracticable. This is further discussed and supported in Section 10 of this ROD.

4.4 Use of a Containment Zone for NAPL

This operable unit remedy isolates the NAPL within a ***containment zone.***[3] The containment zone includes both NAPL and some dissolved phase contamination surrounding the NAPL. Dissolved phase contaminants within the containment zone will be prevented from escaping the containment zone by the remedial actions selected by this ROD. These actions thereby isolate the NAPL and the dissolved phase contamination *inside* the containment zone, from the dissolved phase contamination and clean groundwater *outside* the containment zone. The size of the containment zone is limited in size based on technical principles (discussed in Section 10 of this ROD and Appendix E of the JGWFS).

NAPL dissolution continues to occur within the containment zone, therefore, concentrations of contaminants within the containment zone cannot be appreciably reduced; the containment zone must be contained indefinitely. However, once the containment zone is established, the dissolved phase contamination *outside* the containment zone can be cleaned up to health-based standards because NAPL dissolution no longer effects the groundwater outside the containment zone. All alternatives that EPA considered prior to selecting this remedy (except for the No Action Alternative) assumed that NAPL was isolated within a containment zone in this way. This concept is depicted in Figure 4-2.

Two means are utilized within this ROD for achieving containment of dissolved phase contaminants within the containment zone: (1) hydraulic extraction and treatment, and (2) reliance on intrinsic biodegradation. The application of these means vary depending on the area of groundwater being addressed. This is further discussed in Sections 11 and 12 of this ROD with Sections 7, 9 and 10 providing significant supporting information.

4.5 Two Phases of Remedy Selection to Address Groundwater and NAPL

This operable unit remedy represents the first of *two* phases of remedy selection that will address groundwater and NAPL at these sites. This first phase establishes a containment zone and addresses dissolved phase contamination. More specifically, this phase:

[3]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

(1) ***Contains dissolved phase contaminants in groundwater surrounding the NAPL*** in a containment zone, thereby isolating the NAPL principal threat and the contaminated groundwater immediately surrounding it from the groundwater outside the containment zone; and

(2) Outside the containment zone, ***reduces dissolved phase concentrations*** of contaminants in groundwater to health-based standards and in accordance with the specifications in this ROD.

The second phase of remedial selection for this operable unit will address whether and to what degree ***NAPL Recovery*** and/or ***NAPL immobilization*** shall occur at the Montrose and Del Amo Sites. This distinction between the two phases is further described as follows.

It is important to make certain distinctions between the dissolved phase and the NAPL phase in order to put the two phases of remedial selection into context. While it addresses NAPL by isolating it within an area of groundwater, this first phase remedial action does *not* address ***NAPL recovery***, which refers to removing the NAPL itself from the ground. The action selected by this ROD, therefore, does not significantly affect the mass of NAPL remaining in the ground.

Also, the actions selected in this ROD prevent the migration of dissolved phase contaminants *in the water surrounding the NAPL,* but do not prevent the migration of the NAPL phase itself. While this ROD requires that the remedial action be designed to prevent or limit *inducing* the movement of NAPL, a certain degree of NAPL movement may occur naturally. EPA has determined that this remedy is protective of human health and the environment. However, the potential for movement of the NAPL phase itself in the future, as well as the lingering mass of NAPL, creates uncertainty with respect to the long-term effectiveness of the remedial actions selected in this ROD, and the ability of those actions to maintain protectiveness of human health and the environment over the long term. To address these uncertainties, EPA is performing a second phase of remedial decisionmaking for this groundwater operable unit.

Some degree of NAPL recovery and/or immobilization of NAPL would likely enhance the long-term effectiveness and certainty of long-term protectiveness of the first phase remedial actions selected by this ROD. When NAPL is recovered from the ground, its mass and saturation are reduced. In principle, this can (1) reduce the amount of time that the containment zone must be maintained, (2) reduce the potential for NAPL to move naturally either vertically or laterally, and (3) increase the long-term certainty that the remedial action will be protective of human health and remain effective. In addition to technologies which physically remove NAPL, there are other technologies which, while not removing NAPL from the ground, may reduce its mobility in place, thereby immobilizing it. Evaluations of the potential for NAPL recovery or immobilization to be

effective are underway but have not been completed specifically with respect to the Montrose Chemical and Del Amo Sites.

Whether and to what degree NAPL recovery and/or NAPL immobilization should occur at the Montrose Chemical and Del Amo Superfund sites will be determined in a separate but related second-phase remedial selection process. As of the date of this ROD, EPA is presently overseeing separate feasibility studies (one for the Montrose Chemical Site, and another for the Del Amo Site) that are examining the feasibility of various NAPL recovery and immobilization alternatives. If EPA determines that an additional remedial action is necessary, EPA will select the second phase remedial actions in an *amendment* to this ROD. EPA may issue such an amendment, if any, as a stand-alone document or within the framework of another ROD for the Montrose and Del Amo Site, including final site-wide ROD(s) which may be issued.

Performance of the second phase remedial selection process for this operable unit is authorized by and consistent with the NCP provision at 40 C.F.R. 300.430(f)(5)(iii)(D) which provides that the ROD shall:

> ...When appropriate, provide a commitment for further analysis and selection of long-term response measures within an appropriate time frame.

The second phase is also in accordance with the *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration* [EPA OSWER Directive 9234.2-25, October 1993], which directs that when waivers of applicable or relevant and appropriate requirements (ARARS) are issued based on technical impracticability in groundwater remedies, EPA should demonstrate:

> ...that contamination sources [in the case of the Joint Site, the NAPL sources] have been identified and have been, or will be, removed and contained to the extent practicable [Section 4.3].

This ROD makes no determination or specification as to NAPL recovery or immobilization, or the feasibility of these actions at these sites, other than to determine that enough NAPL cannot be recovered with existing technologies to reduce contaminant concentrations to drinking water standards at all points in the contaminant distribution (this is further discussed in Section 10 of this ROD).

Both the remedial actions selected in this ROD, and any remedial actions for NAPL recovery or immobilization that may be selected by EPA in ROD amendments subsequently, may be necessary to fully address the principal groundwater-related threat. However, because it will be technically impracticable to recover enough NAPL to reduce groundwater concentrations to drinking water standards in the containment zone, the remedial actions selected in this ROD to isolate the NAPL

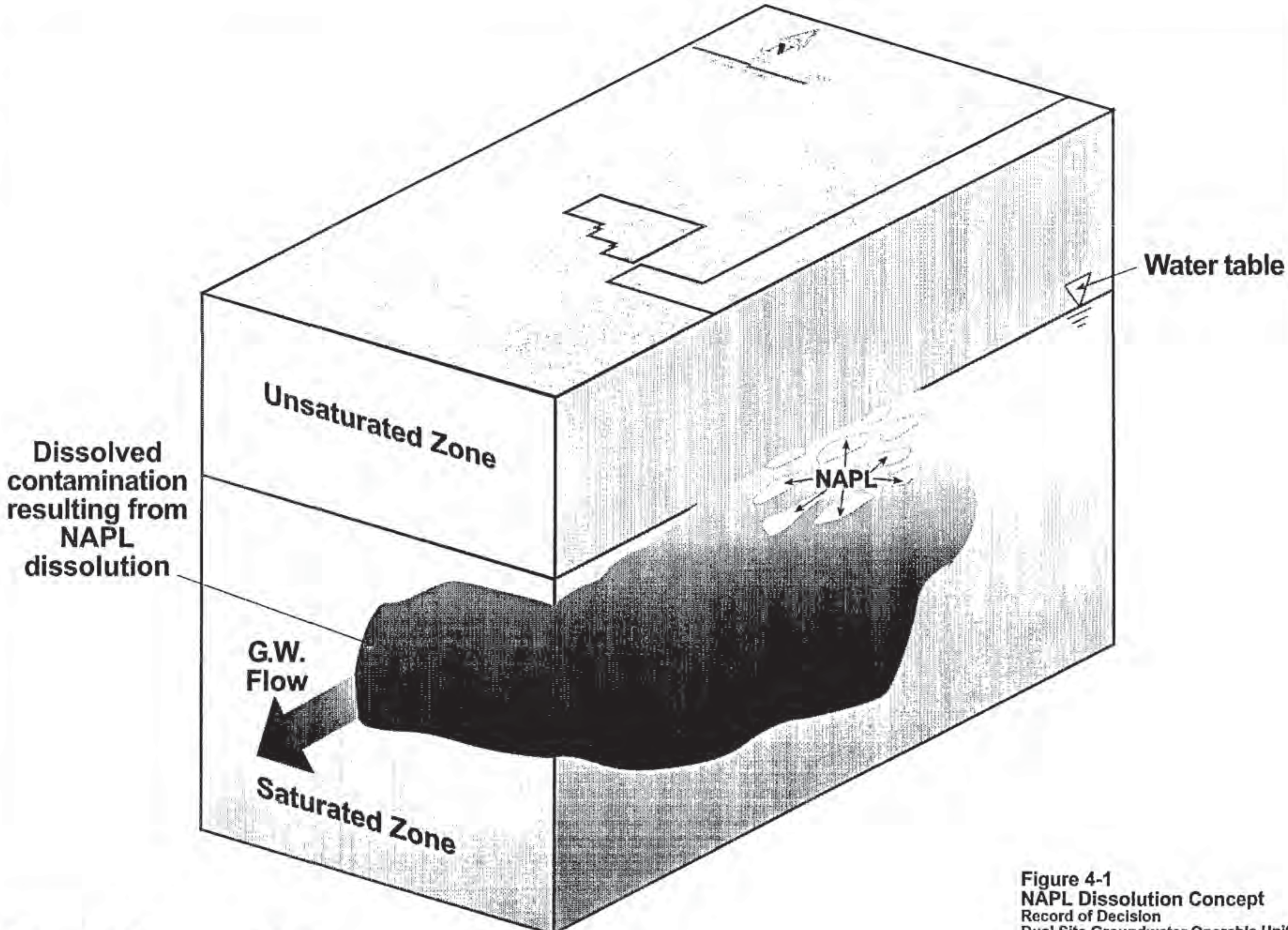
will be necessary *regardless* of the degree of NAPL recovery or immobilization ultimately selected in the second phase. Because of this, and because the process of evaluating alternatives for NAPL recovery or immobilization is not yet completed, EPA is proceeding with the selection of this remedial action in advance of the completion of the remedy selection process where NAPL recovery and/or immobilization will be addressed.

4.6 Finalization of Del Amo Waste Pits ROD

This ROD finalizes the provisions of the Del Amo Waste Pit remedy that EPA had designated as interim when it issued its ROD for that remedy in 1997. Specifications and details related to this are discussed in Sections 12 and 13 of this ROD.

Table 4-1
Affected Media at the Montrose Chemical and Del Amo Superfund Sites
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

MONTROSE CHEMICAL SUPERFUND SITE	DEL AMO SUPERFUND SITE
Groundwater	Groundwater
NAPL	NAPL
Surface soils on and near the original plant property	Surface Soils on the original plant property
Sediments in existing storm water pathways	Indoor air in businesses
Sediments and soils in neighborhoods contaminated by DDT due to historical surface water pathways and/or aerial dispersion	Del Amo Waste Pits area (separate interim ROD finalized by this ROD)
Sediments in the sanitary sewer system	
DDT-contaminated fill in a neighborhood	
DDT-contaminated sediments on the Pacific Ocean floor	



Conceptual Representation

Figure 4-1
NAPL Dissolution Concept
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

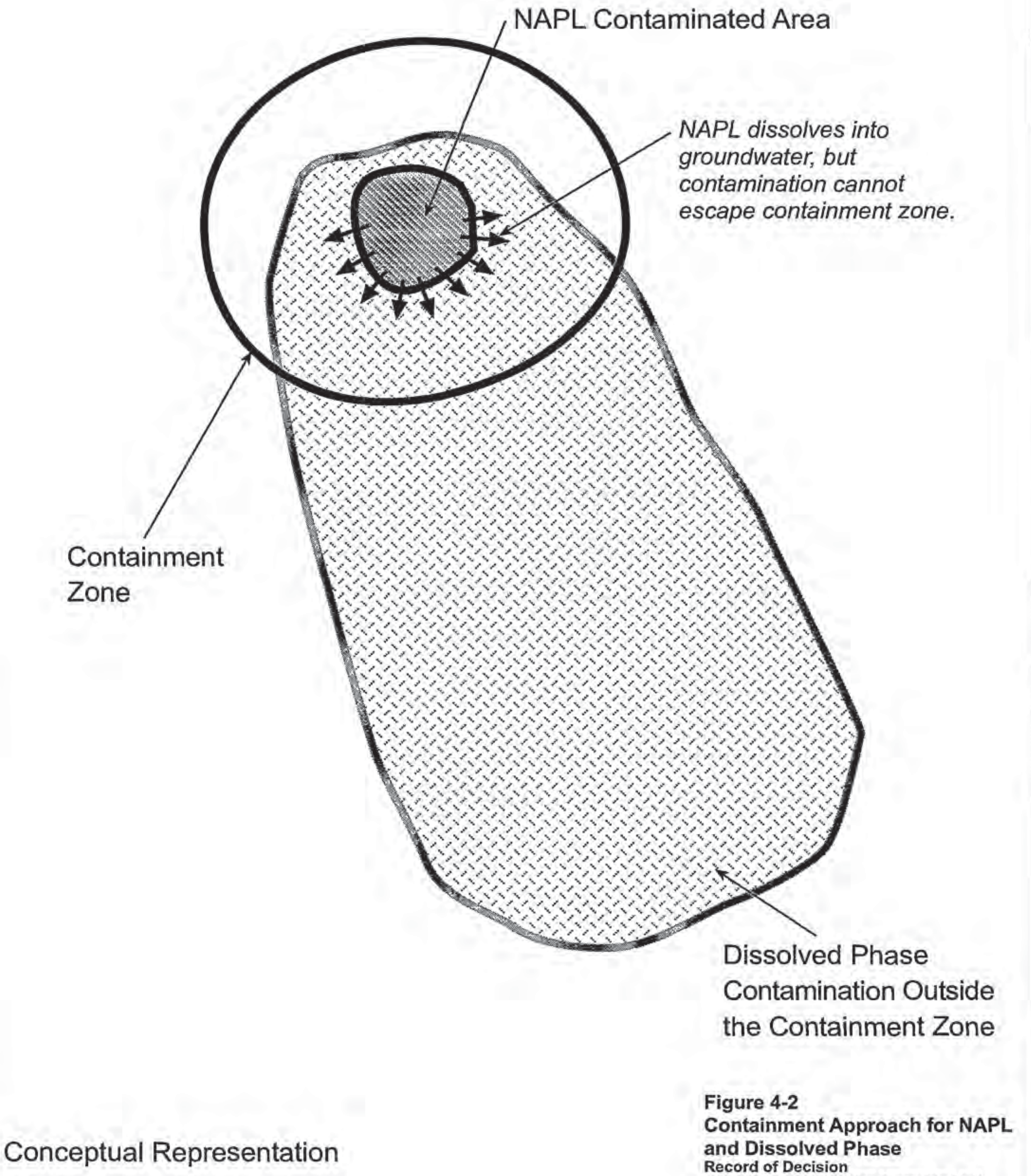


Figure 4-2
Containment Approach for NAPL and Dissolved Phase
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

5. Major Documents

The documents that EPA considered in selecting this remedy appear in EPA's administrative record for this remedy which contains more than 6000 documents and is available at the Torrance and Carson public libraries and at EPA's Region IX Offices in San Francisco. Various documents are also available at the State Department of Toxic Substances Control in Cypress. The following seven documents are required by the NCP and are of particular importance to the remedy selected by this ROD:

1. *Final Remedial Investigation Report for the Montrose Site; Los Angeles, California*; May 18, 1998; originally prepared by Montrose Chemical Corporation of California and Revised by U.S. Environmental Protection Agency, Region IX. 2 volumes.

2. *Final Groundwater Remedial Investigation Report; Del Amo Study Area;* May 15, 1998; prepared by Dames & Moore for the Shell Oil Company and The Dow Chemical Company. 3 volumes.

3. *Final Joint Groundwater Feasibility Study for the Montrose and Del Amo Sites; Los Angeles, California;* May 19, 1998; prepared by CH2M Hill for the U.S. Environmental Protection Agency, Region IX. 1 volume.

4. *Joint Groundwater Risk Assessment; Montrose and Del Amo Sites; Los Angeles County, California*; February 1998; prepared by McLaren Hart for the Montrose Chemical Corporation, and Dames & Moore for the Shell Oil Company and The Dow Chemical Company. 1 volume.

5. *Supplement to the Joint Groundwater Risk Assessment for the Montrose and Del Amo Sites; Los Angeles, California*; May 18, 1998; prepared by CH2M Hill for the U.S. Environmental Protection Agency, Region IX. 1 volume.

6. *Fact Sheet: Montrose and Del Amo Superfund Sites: EPA Proposes Groundwater Cleanup Plan; (General Fact Sheet Version)*; June 1998 by the United States Environmental Protection Agency Region IX. 14 pages.

7. *Remedy Proposed Plan for Dual Site Groundwater Operable Unit, Montrose and Del Amo Superfund Sites; Technical and Expanded Version;* June 1998 by the United States Environmental Protection Agency Region IX. 47 pages plus graphics.

All of these documents appear in EPA's administrative record for this remedy.

6. Definition of the Term "Joint Site"

The National Contingency Plan (NCP), the regulation governing the Superfund Program, defines "on site" at 40 C.F.R. §300.5 as:

> *"...the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action."*

The boundary of a Superfund site occurs at the limits of the areal extent to which contamination has come to be located. Knowledge of this boundary changes as remedial investigations reveal additional areal extent that is contaminated, or as the contamination spreads. It usually is not possible to know with complete certainty all places where contamination has come to be located, even at the conclusion of the remedial investigation, and so in turn the site boundary cannot be known with complete certainty. What is considered the boundary of a site is not static but changes as the knowledge about the extent of contamination changes.

This ROD does not make formal determinations as to the boundaries of the Montrose Chemical Superfund Site nor the Del Amo Superfund Site. Again in accordance with the above definition, each "site" is neither congruent with nor confined by the boundaries of any specific property with which the former Montrose Chemical plant or the former Del Amo plant were associated.

In the case of this remedy, several factors gave rise to the need for EPA to define a term to refer, in concept and by convention, to the area to which the remedy selected by this ROD is assumed to apply:

- As discussed, this ROD is addressing the contamination from the two sites as a single technical problem.
- For convenience and simplicity a shorthand term was needed to encompass the lengthy and awkward reference to groundwater at "the Montrose Chemical and Del Amo Superfund Sites."
- The Montrose and Del Amo Sites lie in an industrial area where other sources of groundwater contamination exist. Some of these other sources will be directly affected by this proposed remedial action, others will not. There needed to be a conceptual (as opposed to absolute) basis for determining how the remedial action selected by this ROD applies to some of these areas and not to others.

- This ROD defines several areas of contaminated groundwater within the Montrose Chemical and Del Amo Superfund sites, to which differing requirements shall apply (e.g. ARAR waivers, containment only, full cleanup, etc.). All such areas occur by definition within the union of the two Superfund sites, and a conceptual basis for this region was needed.

Because of these factors, this ROD does not refer to either site individually unless specifically mentioned. Rather, the ROD uses the term ***Joint Site*** to refer to the area within which the selected remedial action will apply. The area within the Joint Site is based on: 1) the extent of the contamination and 2) the nature and likely effects of the remedial actions selected by this ROD. The latter consideration is included because the remedial action may have a hydraulic influence on certain overlying and surrounding contamination sources that must be considered part of the Joint Site due to their proximity to the remedial action. These hydraulic influences on the sources have been identified with the assistance of the groundwater model (see Section 1.2.3, Section 2, and Appendix B of the Joint Groundwater Feasibility Study (JGWFS), EPA 1988). Specifically, the term "Joint Site" in this ROD refers to:

- The former Montrose Chemical and Del Amo plant properties;

- The areal extent of groundwater affected by the contamination originating or emanating from the former Montrose Chemical and Del Amo plant properties;

- Any areas of groundwater contamination originating or emanating from sources in the vicinity of the former Montrose and Del Amo plant properties that is wholly contained within the areas described in the preceding bullet items;

- Any areas of groundwater contamination that are partially overlapping, or distinct, but in proximity to the areas of groundwater described in the preceding bullet items ***and*** that likely would be significantly affected by the remedial action selected in this ROD.

There are sources of groundwater contamination farther afield surrounding the former Montrose and Del Amo plant properties that are not likely to be affected by this remedy. These sources are not considered to be part of the Joint Site. Most of these are subject to cleanup investigation and/or other cleanup actions directed or overseen by the State of California. While EPA has made no such determination at present, it is possible that in the future such sources would be shown to have an influence on the Joint Site that cannot be avoided. By definition, these sources would then be part of the Joint Site.

The use of the term Joint Site does not imply that a formal Joint Site boundary exists that can be depicted on a map. Rather, EPA intends to give conceptual guidelines as to the area being addressed by the remedial action.

It is further noted that *Joint Site* refers not only to the existing known extent of contamination as described by the above bullet items, but to the *actual* extent of contamination so-described, whether known or not known, both presently and in the future.

7. Summary of Site Characteristics

7.1 Extent and Distribution of Contamination

An understanding of the distribution of contamination in each of the hydrostratigraphic units in question is crucial to the understanding of this selected remedy. The reader is referred to the critical documents listed in Section 5 of this ROD; including the remedial investigation reports and Section 2 of the Joint Groundwater Feasibility Study (JGWFS), for a complete summary of the extent and distribution of contamination. This ROD only summarizes this information.

This remedy defines a number of zones laterally and vertically within the groundwater, and assigns differing remedial actions to each. These zones are based on the characteristics summarized in this section. This ROD relies heavily on the special definition and use of the term ***plume*** for special zones of groundwater. This definition is given later in this section in Section 7.2, "Conventions for Dividing the Contamination into Plumes." A thorough understanding of the use of the term *plume* is essential to comprehension of the remedial action selected by this ROD, and the reader is encouraged to carefully review Section 7.2 before proceeding to other sections of the ROD. The intervening information on contaminant distributions greatly facilitates and elucidates the definition of plumes and is therefore presented first.

Driving Chemicals of Concern for Remedy Selection Purposes

More than 30 hazardous substances and pollutants or contaminants have been detected in groundwater at the Joint Site. These are identified in the remedial investigation reports (see Section 5). Among the hazardous substances or chemicals of concern at the Joint Site are: chlorobenzene, benzene, ethylbenzene, dichlorobenzene, naphthalene, DDT, benzene hexachloride (BHC), chloroform, trichloroethylene (TCE), perchloroethylene (PCE), dichloroethylene (DCE), and trichloroethane (TCA). Of these, however, **benzene, chlorobenzene, TCE and PCE** are by-far the most-widely distributed, consistently detected, and are found in the highest concentrations at the Joint Site. These chemicals also present the greatest potential toxicity to a potential groundwater user when their innate toxicity and concentrations are considered together (See Section 8, Summary of Groundwater-Related Risks).

While EPA's risk assessment addressed all chemicals in groundwater, EPA's feasibility study focused on remedial actions for these four chemicals. The distributions of all other chemicals in groundwater at the Joint Site, except pCBSA, fall within one or more of the distributions of these three chemicals. EPA has determined that the same remedial actions selected for chlorobenzene, benzene, TCE, and PCE will also address the other chemicals of concern in the course of remedial

implementation. Requirements in this ROD that apply to chlorobenzene, benzene, TCE and PCE also shall apply to the other chemicals in the contaminant distributions at the Joint Site, as specified in this ROD.

TCE, PCE, DCE, and TCA are chlorinated aliphatic organic solvents. For simplicity, unless otherwise noted, the term "TCE" hereafter in this ROD refers to TCE, PCE, DCE, and TCA.

The chemical pCBSA is also present in groundwater. The distribution and remedial action selected for this contaminant represents an exception to the statements in the preceding paragraph. pCBSA is addressed separately from the other contaminants as further-described in Sections 8, 11, 12, and 13 of this ROD.

Non-aqueous Phase Liquids (NAPL)

As described previously in Section 4 of this ROD, several of the hazardous substances and chemicals or concern at the Joint Site are present both in the dissolved phase and as NAPL. The NAPL is the primary principal threat at the Joint Site. The NAPL continues to dissolve in the groundwater, feeding the distribution of dissolved contamination which can move in the groundwater laterally and vertically and pose a health threat. It is the NAPL which gives rise to the inability to cleanup all groundwater at the Joint Site (See Section 10) and the need to develop strategies in which the contamination surrounding the NAPL is contained and isolated (discussed in Section 4, 9, 10, and 11). Because the NAPL largely provides the genesis for the dissolved phase contamination, the nature and extent of NAPL at the Joint Site is discussed in this section in advance of discussing the distribution of dissolved phase contamination, and "plumes" of groundwater contamination. The distribution of dissolved phase contamination, and its behavior, is better understood in the context of the nature and distribution of NAPL sources.

DNAPL at the Montrose Chemical Superfund Site

Chlorobenzene is the primary chemical which occurs as NAPL at the former Montrose plant. Chlorobenzene is a dense non-aqueous phase liquid, or ***DNAPL***, which means it is denser than water and tends to sink in aqueous media due to a positive density gradient. DNAPL likely entered the ground at the Montrose Chemical Site through the bottom of the Montrose waste disposal pond, through trenches, and via the operations such as the filter press rework facility (See Chapter 1 of the Montrose Site RI Report, EPA 1998). DNAPL at the Montrose Chemical Site may have penetrated as far as the Gage Aquifer (see Section 2 of the JGWFS and discussion of hydrostratigraphic units, below) to a depth potentially exceeding 130 feet below the ground surface. The exact depth to which NAPL has migrated is not known, but the lack of such knowledge is not unusual at NAPL sites because making determinations of NAPL depth and distribution can be exceedingly difficult, particularly in the heterogeneous soils found at the

Montrose Chemical Site. Concentrations of chlorobenzene in groundwater in the Gage aquifer remain reasonably consistent with the presence of DNAPL. Concentrations in the Lynwood Aquifer do not appear to be consistent with the presence of NAPL at this time.

In a treatability test at the former Montrose plant, DNAPL was actively pumped from the MBFB Sand (see discussion of hydrostratigraphic units, below) at rates of up to 10 gallons per day, which demonstrated that mobile DNAPL (i.e. above residual saturation levels) is present in some locations under the former Montrose plant property. DNAPL resides in a lateral area of about 600 feet by 350 feet, centered on the Central Processing Area of the former plant (See Section 2 and Appendix E of the JGWFS). The total mass, volume, and relative saturation distribution of the DNAPL is unknown, though this also is not unusual at DNAPL sites. Multiple lines of evidence indicate that there are significant quantities of DNAPL beneath the Central Processing Area of the former Montrose plant, including: (1) chlorobenzene concentrations in groundwater over a significant area near the NAPL are at or near the saturation limit, (2) a significant amount of DNAPL can be removed by hydraulic extraction (pumping), and (3) DNAPL accumulates in some wells even when no pumping is taking place.

Data indicate that the chlorobenzene DNAPL contains a significant percentage (perhaps up to 50%) of dissolved DDT. This does *not* refer to DDT dissolved in the aqueous phase, but to DDT dissolved in the chlorobenzene DNAPL itself. This process is called co-solvation. Chlorobenzene is an effective organic solvent for DDT (i.e. DDT has a high solubility in pure chlorobenzene). DDT at the former Montrose plant normally adsorbs strongly to soils and therefore remains contained in the top several feet of soil. However, where chlorobenzene NAPL is present, significant DDT is co-solvated in the chlorobenzene. The DDT dissolved in chlorobenzene DNAPL migrated with the DNAPL to the groundwater. This transport process allowed DDT to reach the groundwater. However, because of DDT's low water solubility, the distribution of dissolved DDT is limited, and represents a tiny fraction of the distance that dissolved-phase chlorobenzene has migrated in groundwater.

Dissolved chlorobenzene has left the Montrose property and has migrated laterally up to 1.3 miles in five successively deeper aquifers (See below). While dissolved contamination has been able to migrate vertically from shallower to deeper hydrostratigraphic units, it is highly likely that the expansion of dissolved groundwater contamination in the deeper units was greatly hastened as NAPL arrived in the deeper units, allowing dissolution to originate directly in those units. Due to the extensive depth and quantity of DNAPL and other factors, EPA considers it technically impracticable to remove enough DNAPL to allow for attaining drinking water standards in the groundwater in the vicinity of the DNAPL. Support for this conclusion is provided in the Joint Groundwater Feasibility Study, Appendix E, and summarized in Section 10 of this ROD.

LNAPL at the Del Amo Superfund Site

To the east of the former Montrose plant at the former Del Amo plant, benzene is the primary chemical present as NAPL. Benzene, when in NAPL form, is less dense than water and therefore tends to float upward in aqueous media under a negative density gradient (buoyancy forces). This is referred to as Light NAPL, or ***LNAPL***. This LNAPL originally spread out and floated on the water table when the water table was lower. In the 1960s, the local groundwater basin was adjudicated to reduce the amount of water being withdrawn from the basin and, in turn, limit saltwater intrusion into the basin. As less water was withdrawn from production wells, the water table slowly but steadily rose and overtook the LNAPL, smearing it upward. As a result of this upward movement in the heterogeneous sediments of the Upper Bellflower (see description of hydrostratigraphic units, below), some LNAPL was trapped underneath the water table by layers and lenses of the low-permeable formations. Most of the benzene LNAPL that was discovered during the remedial investigation to date at the former Del Amo plant property now occurs in the *saturated* zone, near and under the water table. At some of the source areas where NAPL investigations remain ongoing, LNAPL could also be present in the vadose zone and/or floating on top of the water table, in addition to being present below the water table. LNAPL sources are depicted in Figures 2-3a and 2-3b of this ROD, in Section 2 and Appendix E of the JGWFS, and in the Del Amo Groundwater Remedial Investigation Report.

LNAPL at the Del Amo Site occurs in several distinct locations, separated by no more than 600-1000 feet. These LNAPL sources have been slowly dissolving into groundwater, and have therefore resulted in corresponding distributions of dissolved contamination, which have largely merged and overlapped over time. These areas of LNAPL and dissolved phase benzene contamination were also discussed in Section 2 of the JGWFS (see also figures 2.3a and 2.3b), and in the Del Amo Groundwater RI Report.

An extensive amount of NAPL-related data has been collected at the ***MW-20 Area***, which refers to the area around Monitoring Well No. MW-20. This well is located near what was historically a crude benzene storage tank of at least 500,000 gallons capacity, and a number of pipelines which carried benzene at the former Del Amo plant. Floating benzene product has been observed in this well. An extensive number of borings were drilled in this area and analyses of microstratigraphy as well as LNAPL indicator techniques were used. In addition, a six-month hydraulic extraction test was performed in which four NAPL extraction wells were pumped. Only approximately 23 gallons of benzene LNAPL was recovered, while a total of about 400,000 gallons of water was pumped, which results in a total LNAPL: water ratio (fluid ratio) of 0.00006 to 1. The results of this test, in conjunction with the LNAPL saturation data obtained by laboratory analyses of the selected soil sampled, indicated that the NAPL near the wells is likely to be present at relatively low average saturations. While an overall effort to assess NAPL at the MW-20 area was more extensive than that performed at most NAPL sites, the actual distribution of LNAPL, LNAPL

saturation, and the total LNAPL mass in the subsurface cannot be determined with a high degree of certainty from these studies. As previously stated, such determinations are exceedingly difficult to make in virtually all large sites with NAPL where stratigraphy is highly heterogeneous, as is the case at the Joint Site. As mentioned earlier, studies at both the Montrose Chemical and Del Amo Sites continue with respect to the evaluation of NAPL characteristics and the potential for NAPL recovery and immobilization.

The historical operations and the high concentrations of dissolved benzene in groundwater at the locations of the waste pits, the tank farm, and the styrene plant production units (east of the tank farm) are consistent with and strongly suggestive of a NAPL source in these areas. Mixtures containing NAPL were disposed in the waste pits. NAPL has not been directly detected in wells at these locations; however, this does not preclude the presence of NAPL. It is highly likely that NAPL is present but at low enough saturations that it would not flow into the wells. Additional sampling is taking place to characterize these areas with respect to NAPL for the second phase of remedial decisionmaking for this operable unit which shall address NAPL recovery/ immobilization, as previously discussed in the Declaration and in Section 4 of this ROD. It is important to note that precisely locating NAPL can be difficult, and further investigation may or may not directly reveal the NAPL presence, even though NAPL is present. For this reason, the presence of NAPL is evaluated not only from the standpoint of its presence in wells but the entire historical context and observed characteristics of contamination in these areas.

Recent studies using the Remedial Optical Scanning Tool (ROST™) near the former laboratories in the butadiene plancor and near the pipeline directly east of the waste pits have confirmed the presence of NAPL with relatively high certainty. Dissolved benzene concentrations in groundwater in well XMW-04HD near the pipeline east of the waste pits have been measured in excess of 1 million parts per billion (ppb), which is more than half the solubility limit for benzene. This provides exceptionally strong evidence for the presence of NAPL at this location.

It appears that the NAPL at other locations at the Del Amo Site occurs as "smeared" under the water table, similar to that at the MW-20 area. However, there is the possibility that LNAPL may be present in the vadose zone or floating on top of the water table at any of the LNAPL source areas defined in the JGWFS (See Section 2 of the JGWFS).

Hydrostratigraphic Units and Groundwater Flow

As shown in Figure 7-1, there are seven hydrostratigraphic units under the Joint Site that are currently affected by contamination. These are: the Upper Bellflower (UBF), the Middle Bellflower "B" Sand (MBFB Sand) the Middle Bellflower "C" Sand (MBFC Sand), the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer. The water table is inclined relative to the interface between the UBF and the MBFB Sand, and it crosses this interface roughly between the two sites. Therefore, the water table occurs in the UBF at most of the Del Amo site, but it occurs in the MBFB Sand at the Montrose Chemical Site. The UBF is only saturated under (most of) the former Del Amo plant - it is unsaturated under the former Montrose plant.

The greatest contaminant migration potential, as well as the greatest potential facility in applying hydraulic extraction or aquifer injection, exists in the coarser-grained MBFC Sand, Gage Aquifer, and Lynwood Aquifer, because of the relatively higher hydraulic conductivity of these units. These units typically can sustain maximum pumping rates of 50-100 gpm per well. The UBF and MBFB Sand are much finer-grained and can typically sustain maximum pump rates on the order of 1 gpm and 10 gpm, respectively, at the Joint Site. The degree of heterogeneity of the UBF and MBFB Sand is high, especially near the former Montrose plant. The State of California has classified all hydrostratigraphic units under the Joint Site, including the UBF and MBFB Sand, as potential drinking water sources.

The lateral hydraulic gradient of the groundwater varies locally in the upper units, but is largely consistent in the MBFC Sand and all hydrostratigraphic units beneath it. The direction of groundwater flow in the UBF has local perturbations but is generally to the south. The groundwater flow direction in the MBFB Sand, MBFC Sand, Gage Aquifer, and Lynwood Aquifer, is to the south to south/southeast. The magnitude of the eastward component of the horizontal groundwater flow vector increases slightly as the depth of the unit increases. Under natural gradients (i.e. in the absence of local pumping) the vertical component of the hydraulic gradient is generally downward between all hydrostratigraphic units discussed above.

Wells were not installed in the aquitards (the LBF and the Gage-Lynwood Aquitard) in the course of the remedial investigation. Monitoring these units is extraordinarily difficult due to their low hydraulic conductivities.

Generalized Dissolved Contaminant Distributions

The distribution of dissolved-phase contaminants at the Joint Site is based on remedial investigation efforts performed, with EPA oversight, both by Montrose Chemical Corporation for the Montrose Chemical Site, and Shell Oil Company and Dow Chemical Company for the Del Amo Site. More than 100 wells have been installed. In addition, wells previously-installed by other parties have been sampled and/or past sampling data associated with such wells has been obtained. Figure 7-2 shows the overlapping distributions of benzene, chlorobenzene, and TCE in the UBF, MBFB Sand, MBFC Sand, and Gage Aquifer. The superimposed icon represents the hydrostratigraphic layers in the vertical plane and serves to orient the surrounding lateral plane figures. The observations discussed below are crucial to the development of the zones of groundwater to which remedial actions under this ROD are established.

The chlorobenzene downgradient of the former Montrose plant has moved as far as about 1.3 and 0.6 miles from the Montrose plant source in the MBFC Sand and Gage Aquifer, respectively. This contamination has traversed all of the water-bearing units above the Silverado Aquifer. Near the DNAPL source at the former Montrose plant, chlorobenzene is present in concentrations up to its solubility limit, near 400,000 ppb.

Concentrations of benzene up to its solubility limit, approximately 1,700,000 ppb, are present at the Joint Site, both near the former Montrose Chemical plant and the former Del Amo plant, near benzene LNAPL sources. The dissolved benzene distribution displays differing characteristics depending on its location.

In contrast to the chlorobenzene distribution, the dissolved benzene distribution near the LNAPL sources at the former Del Amo plant relatively closely surrounds the NAPL itself (Figure 7-3). This benzene lies outside (is not presently commingled with) the chlorobenzene distribution. There are very steep benzene concentration gradients in this portion of the benzene distribution.

There is also dissolved benzene at the Joint Site that *is* commingled with the large chlorobenzene distribution. In contrast to the benzene near the NAPL sources under the former Del Amo plant, the benzene that is commingled with the chlorobenzene does not exhibit steep concentration gradients at the leading (i.e. downgradient) edges of the plume, but rather a flatter and larger distribution similar to that found in the chlorobenzene plume (Figure 7-2).

TCE (including, by reference, the related chlorinated organic solvents such as PCE) is present both within the Joint Site and in the areas surrounding the Joint Site. The TCE within the Joint Site is present (1) commingled with the chlorobenzene distribution under and just downgradient of the former Montrose plant, and (2) in another distribution not commingled with (outside) the chlorobenzene distribution extending upgradient of and beneath the former Del Amo plant

(Figure 7-2).

Concentrations of TCE are present in groundwater up to about 9,400 ppb at the Joint Site. With respect to the TCE near the former Del Amo plant, the proximity of the TCE distribution to the benzene distribution differs with the hydrostratigraphic unit. In the Upper Bellflower and the MBFB Sand, the TCE is commingled with the benzene, but in the deeper MBFC Sand, data from the remedial investigation indicates that the TCE distribution is still to the north of the benzene distribution, which is limited to the area under the Del Amo Waste Pits at the southern end of the former Del Amo plant. Therefore, in the MBFC Sand, under and near the former Del Amo plant, the TCE and the benzene are not commingled (Figures 7-4 and 7-2).

There are fewer data available pertaining to the TCE present near the former Del Amo plant than for chlorobenzene and benzene. TCE at these locations may or may not be present as DNAPL. Additional field data about the TCE distribution will be necessary in remedial design; however, the remedial actions selected by this ROD for TCE are justified based on the data that are available. PCE is present in distributions largely similar to those for TCE, but, for the most part, in lower concentrations. The concentrations of chlorinated solvents at the Joint Site are small in comparison to those for chlorobenzene and benzene, but still are up to thousands of times above the drinking water standards for these compounds.

Because it is much more water-soluble than chlorobenzene, pCBSA is more mobile in groundwater and the lateral extent of the pCBSA in groundwater exceeds that of the chlorobenzene in all directions. The pCBSA plume is commingled with the benzene on the west side of the former Del Amo plant. The maximum concentration of pCBSA is about 1,500,000 ppb, near the Central Process Area. The concentration of pCBSA is 500-1000 ppb at the toe of the chlorobenzene plume (point where chlorobenzene concentrations are at the MCL for chlorobenzene, which is 70 ppb). The pCBSA distribution is shown in Figure 7-5. Because it has no promulgated or provisional health-based standards associated with it, pCBSA is addressed independently of all other chemicals in this ROD. See Sections 11, 12, and 13 for actions selected with respect to this contaminant and Section 8 for a discussion of its toxicological status.

7.2 Conventions for Dividing the Contamination into Plumes

As can be seen in the discussion of contaminant distributions above and in Figure 7-2, the groundwater contamination at the Joint Site displays differing physical, chemical, spatial and situational characteristics depending on its location within the overall contaminant distribution. Most notably, such characteristics differ widely depending on whether chlorobenzene is present. Where chlorobenzene is absent, such characteristics also differ depending on the relative spatial distributions of the other primary contaminants (most notably benzene and TCE) to each other.

As previously discussed, this ROD selects a single unified action; all remedial actions selected in this ROD have been considered as part of an interrelated whole. However, because of the differences just mentioned, it was necessary in the development and evaluation of remedial alternatives to make distinctions among various portions of the overall contaminant distribution in groundwater. The particular physical and chemical properties exhibited by the combinations of contaminants in groundwater appeared to be a better basis for evaluating remedial alternatives than did a simple consideration of where any given contaminant was located. For instance, because the benzene commingled with the chlorobenzene exhibits differing characteristics than the benzene not commingled, it would have been tedious and complicated, and likely would have lead to confusion, to try to evaluate remedial actions for "the benzene," if referring to all benzene at the Joint Site.

In order to facilitate the evaluation and selection of remedial alternatives, EPA defined and identified areas that were subsets of the overall groundwater such that one set of remedial objectives and requirements could apply within each area, consistent with the particular chemical and physical characteristics of the groundwater within the area. By convention, EPA has used the term ***plume*** to refer to each of these areas. These plumes are depicted in Figure 7-6 and discussed below.

In order to avoid confusion, it is particularly important to note that *plume* is not used in this ROD in its most-common sense. Usually, the term refers to the entire distribution of a particular contaminant in groundwater at a given site. So, for instance, "chloroform plume" would usually mean the distribution of chloroform in groundwater. In the more specialized case of this ROD, *plume* refers to a defined area in the groundwater based on physical and chemical characteristics. Under this approach, a plume in some cases includes only a subset of the distribution of the chemical bearing its name. Hence, for example, in this ROD the term *benzene plume* does not refer to all benzene in groundwater at the Joint Site; and, there is benzene in the *chlorobenzene plume* not considered to be part of the benzene plume. The term "plume" refers to all hydrostratigraphic units in which the contamination identified by the plume definition occurs, unless otherwise noted.

EPA has not defined the plumes for the purposes of allocating responsibility or liability for cleanup, or to designate from which site (Montrose Chemical or Del Amo Site) particular contamination in groundwater originated. For instance, the contributions of benzene may have arrived in either the chlorobenzene plume or the benzene plume from multiple sources. The purpose of this ROD is simply to select the remedial actions that will address contamination in Joint Site groundwater.

The JGWFS considered a separate set of remedial options, which it called "scenarios," for each plume. Each full remedial alternative considered in the JGWFS contained one scenario for each plume. Because each scenario for one plume had potential interrelationships with scenarios for the other plumes, this process could not be achieved by simply combining scenarios considered independently for each plume. Rather, the JGWFS screened and evaluated scenarios for each plume individually first, with respect to the immediate objectives for each plume. Then the JGWFS performed a second screening and evaluation in assembling the scenarios into alternatives. This second evaluation considered potential interactions and interrelationships that would exist if scenarios for differing plumes were implemented together. Only those combinations of scenarios for each plume which survived the second screening were evaluated as full alternatives in the detailed analysis of alternatives.

Upon consideration and evaluation of the information derived during the remedial investigation and feasibility study, EPA decided that the smallest reasonable number of plumes which can be used to define the Joint Site is three. The union of the three plumes encompasses all groundwater at the Joint Site; hence, actions selected for each of the plumes completely address the Joint Site groundwater. The basis for the EPA's decision to use these particular plumes is provided in the course of the ensuing discussions in this ROD with regard to the presence of reliable intrinsic biodegradation, the designation of the TI waiver zone, the technical considerations pertaining to the benzene and TCE plume, and the remedial alternatives considered for this remedy.

The plumes are defined below. These definitions are repeated in Section 13 of this ROD to facilitate the use of that section and for clarity. Section 13 contains other requirements and specifications with respect to the plumes which shall apply in this remedy.

- ***Chlorobenzene plume*** refers to the entire distribution of chlorobenzene in groundwater at the Joint Site, *and* all other contaminants that are commingled with the chlorobenzene. Benzene, TCE, PCE, and a variety of other contaminants are present within the chlorobenzene plume. The chlorobenzene plume is present in the MBFB Sand (note that the UBF is generally not saturated in the area where the chlorobenzene plume occurs), the MBFC Sand, the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer, based on data collected in the remedial investigation.

- ***Benzene plume*** refers to the portion of the distribution of benzene in groundwater at the Joint Site *that is not commingled* with chlorobenzene. Put another way, the benzene plume is that benzene within the Joint Site that lies outside the chlorobenzene plume. The benzene plume occurs in the Upper Bellflower, the MBFB Sand, the MBFC Sand, and may occur in the LBF, based on data collected in the remedial investigation. Benzene that is commingled with chlorobenzene is not considered to be part of the benzene plume, but is instead part of the chlorobenzene plume. The benzene plume includes ethyl benzene and naphthalene, among other contaminants.

- ***TCE* and *TCE plume***. The term *TCE,* when used in this ROD, unless otherwise noted, represents a series of chlorinated solvents, including TCE, PCE, DCE, TCA, and any isomers of these compounds in groundwater at the Joint Site. The term *TCE plume* refers to the portions of the distributions of any such contaminants in groundwater at the Joint Site *that are not commingled* with the chlorobenzene plume. The TCE plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, and may occur in the LBF, based on data collected during the remedial investigation. The TCE plume in the Upper Bellflower and MBFB Sand is commingled with and contained within the benzene plume; the TCE plume in the MBFC Sand lies *under* the benzene plume in the MBFB Sand and north of the benzene plume in the MBFC Sand (See Figure 7-4). TCE (chlorinated solvent) contamination outside the chlorobenzene plume which may exist in the Gage Aquifer is addressed separately and not as part of the TCE plume. TCE that is commingled with chlorobenzene is not considered part of the TCE plume but is part of the chlorobenzene plume.

Figure 7-6 shows the three plumes (see legend). Note that this Figure uses, as a base, Figure 7-2 which shows the actual distribution of the major contaminants. However, Figure 7-6 outlines the actual plume boundaries on this distribution. Notice, for example, that the benzene commingled with the chlorobenzene is visible on Figure 7-6; but that such benzene is in the *chlorobenzene plume,* not in the benzene plume.

Some of the requirements and provisions in this ROD differ according to the plume being referenced. Additionally, this ROD in some instances assigns differing remedial action requirements to various hydrostratigraphic units *within* a plume (e.g. the benzene plume in the MBFC Sand versus the benzene plume in the MBFB Sand). The specifications and requirements are established in Section 13 of this ROD.

7.3 Presence of Intrinsic Biodegradation

The term ***intrinsic biodegradation*** refers specifically to the process of the chemical breakdown of a contaminant by microorganisms that are native and innate to the existing soils. In general, intrinsic biodegradation occurs in association with the metabolic processes of microorganisms which use inorganic materials in soil (such as oxygen, nitrate, sulfate, and ferric iron) as terminal electron acceptors and break down the contaminant into carbon dioxide, water, and in some cases, methane. The microorganisms then live off the energy produced by such processes.

Intrinsic biodegradation is a specific form of the more general term, ***natural attenuation***. While natural attenuation sometimes is used so as to be synonymous with intrinsic biodegradation, the former can also refer to other processes, including but not limited to dilution and dispersion.

This ROD makes a distinction between natural attenuation and intrinsic biodegradation because EPA has evaluated the potential for *relying* on intrinsic biodegradation (specifically, as opposed to all forms of natural attenuation) as a remedial mechanism to assist in obtaining remedial objectives at the Joint Site. This is discussed in detail in Sections 11 and 12. This ROD and the JGWFS make use of the more specific term to remove ambiguities that might arise.

It should be noted that, as intrinsic biodegradation is a specific form of natural attenuation, the two are consistent terms in the context of EPA's policy, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,* (EPA OSWER Directive 9200.4-17, December 1997).

As this section focuses on site characteristics and not yet on remedial selection, only a short presentation as to the *presence* of intrinsic biodegradation is provided here. It is important to note that there is a key difference between demonstrating the presence of intrinsic biodegradation at a site, on one hand, and demonstrating its reliability as a remedial mechanism in a remedy selection process, on the other. The latter is addressed in Section 11 of this ROD.

Potential for Intrinsic Biodegradation in the Benzene Plume

At the Joint Site, there is substantial and significant evidence that significant intrinsic biodegradation of the benzene plume is occurring in the UBF, MBFB Sand, and MBFC Sand. These factors include:

- The concentration gradients at the leading edge of the benzene plume are steep;
- The lateral extent of the dissolved plume outside of the NAPL sources is small;

- The benzene plume is much smaller than what would be expected based on groundwater velocity and expected retardation in the absence of intrinsic biodegradation; benzene has not migrated far from the NAPL sources despite likely being in the ground 20-40 years;

- The plume appears to be at stable and does not appear to be migrating laterally;

- In-situ measurements of geochemical parameters (e.g. dissolved oxygen, nitrate, sulfate, methane, etc.) indicate biological activity that is related to (varies spatially with) the benzene concentration in groundwater;

- Biodegrader organism counts in groundwater indicate greater biological activity inside the benzene plume than outside the benzene plume;

- Computer modeling runs could not be reasonably calibrated without assuming significant benzene biodegradation.

Potential for Intrinsic Biodegradation in the Chlorobenzene Plume

The lines of evidence just discussed for the benzene plume do *not* exist for the benzene that is commingled with the chlorobenzene plume (this benzene is, by definition, *in* the chlorobenzene plume). This benzene has migrated up to ¾ mile in the MBFC Sand from the former Montrose Chemical and Del Amo plants with no known intervening sources.

Similarly, observations do not support the presence of intrinsic biodegradation in the chlorobenzene plume. The chlorobenzene plume has migrated up to 1/3 miles from the former Montrose plant, has traversed six hydrostratigraphic units, and is more than 1000 feet wide at its widest point. Contamination has not remained near the sources. Concentration gradients are relatively flat. Moreover, even though the modeling effort performed in the remedial selection process (see Section 11) assumed no degradation of chlorobenzene, approximate attempts at modeling transport calibration resulted in less simulated migration than that observed, further indicating a lack of significant chlorobenzene intrinsic biodegradation. The rate of biodegradation of chlorobenzene has not been directly measured nor modeled for several reasons which are presented in Appendix B of this ROD, and is discussed in the Response to Comments received from Montrose Chemical Corporation. More critical details on the issue of the potential for the reliability of intrinsic biodegradation of chlorobenzene are presented in Section 11 of this ROD.

Potential for Intrinsic Biodegradation in the TCE Plume

EPA has not measured nor modeled the rate of intrinsic biodegradation of TCE within the TCE plume. The limited modeling of TCE migration in the JGWFS, which was performed only for No Action assumptions, assumed that TCE degrades at rates similar to those found at other sites (See Section 2 and Appendix B of the JGWFS). It is important to note that data from the remedial investigation indicate that TCE and PCE are migrating under existing conditions (that is, the TCE plume is not presently spatially stable with time, and is not naturally contained by intrinsic biodegradation). However, as assumed by the limited modeling of TCE in the JGWFS, intrinsic biodegradation may be occurring to some degree in the TCE plume. In fact, the significant rate of biodegradation of benzene in the benzene plume may be enhancing the rate of biodegradation of TCE in a process called co-degradation. This could potentially result in reductions in the field resident half-life of TCE at the Joint Site compared to typical half-lives for TCE in the absence of benzene biodegradation.

7.4 Land Use and Zoning

A brief discussion of the land use and zoning was given in Section 1 of this Decision Summary. Land use at the Joint Site facilities includes heavy and light industrial, commercial, and residential zoning. Government jurisdictions within the Joint Site include the City of Los Angeles and unincorporated Los Angeles County. The Cities of Torrance and Carson lie to the west and east, respectively, of the Joint Site which lies primarily within the Harbor Gateway (see Section 1 of this ROD).

The former Montrose plant property is vacant and sits under a temporary asphalt cover. This property is zoned industrial. The former Del Amo plant property has been subdivided and redeveloped and contains light industrial enterprises. This property is zoned industrial and commercial. Areas directly south of the former Del Amo plant and southeast and southwest of the former Montrose plant contain primarily low-income residential properties. Some of these homes lie in unincorporated Los Angeles County. The general area surrounding the former plant properties includes industrial, commercial, and residential zoning. In several instances, heavy industrial and residential land use are adjacent to the former plant properties, particularly where islands of Los Angeles county jurisdiction exist among the Harbor Gateway and the Cities of Torrance and Carson (See Figure 7-7). Active petroleum refineries are operating within several miles to the east and west of the former plant properties.

Low-to-moderate-income residential areas lie adjacent to the two former industrial plants. Most of the benzene plume lies under the former Del Amo plant, but some of it lies under the northern edge of the residential zone south of the former plant. Most of the chlorobenzene plume lies under residential and commercial areas south and southeast of the former Montrose plant;

although most of this portion of the chlorobenzene plume is in the MBFC Sand and Gage Aquifer, with most of the overlying water table zone being uncontaminated. The TCE plume (as specifically defined in this ROD) lies entirely within industrial areas. An estimated 2400 homes lie within one mile and 3000 people live within one quarter mile to the south, southeast, and southwest of the former Montrose plant.

7.5 Groundwater Use and Designations

The State of California designates all of the water-bearing hydrostratigraphic units under the Joint Site as having potential potable beneficial use, i.e. as being a potential source of drinking water. Therefore, EPA considers drinking water standards (maximum contaminant levels, or MCLs) to be relevant and appropriate requirements for in-situ cleanup of groundwater at the Joint Site (See Section 9 of this ROD). The ARARs pertaining to this determination are discussed in Appendix A of the ROD.

There currently is no known municipal water or municipal production wells in use within the area of contaminated groundwater under the Joint Site. EPA also is not aware of current use of private potable water wells within the contaminated groundwater affected by the Joint Site. The nearest municipal supply wells are about ½ to 1 mile downgradient of the current leading edge of the chlorobenzene plume in the MBFC Sand. These wells are screened primarily in the Silverado aquifer, though some are screened in the Lynwood Aquifer. Wells within a 2-mile radius of the Joint Site are shown on Figure 7-8. The Silverado Aquifer is the most extensively used water-bearing unit for municipal supply purposes in the southern west coast groundwater system. This aquifer occurs at approximately 450 feet below land surface near the Joint Site. There are a number of other private and industrial wells within a mile of the plume, some of which have screens in the Gage Aquifer. None of these are located within the current contaminant distribution of the Joint Site. It appears likely that some water use within the Joint Site would exist if the aquifers were not contaminated. The groundwater basin under the Joint Site is presently adjudicated to reduce salt water intrusion problems which were occurring in the 1960s. At present, this would limit, but not eliminate, the degree of use of groundwater in the area were the groundwater not contaminated.

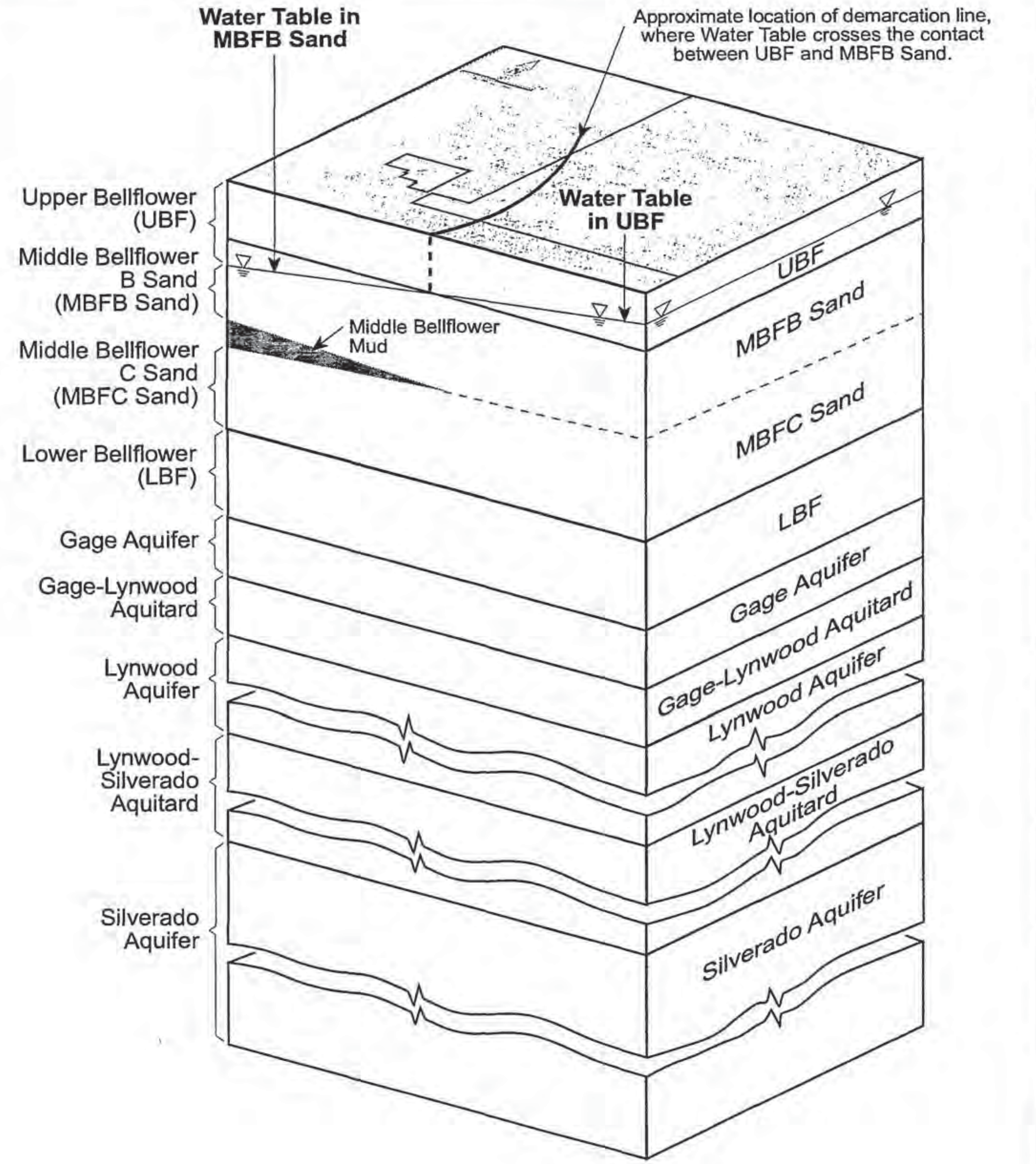
EPA is concerned that the groundwater contamination may continue to move both laterally outward and vertically downward, and may eventually reach locations where it would be drawn into wells which are used for drinking or other potable purposes. As contamination spreads, less of the groundwater resource can be used in the future.

The laws and policies of the State of California are generally focused on protecting potential future beneficial uses of groundwater, even where it is not currently used. In addition, the National Contingency Plan (NCP) requires that EPA consider future potential groundwater uses

in making decisions on remedial actions for groundwater.

Without the Joint Site contamination, the Lynwood and the Gage Aquifers would be of sufficient water quality and production to make them strong candidates as actual sources of drinking water. The MBFC Sand and shallower units contain sufficiently high levels of total dissolved solids and total suspended solids such that future direct use of the water, particularly for potable purposes, would be less likely. In addition, the MBFB Sand and Upper Bellflower units generally do not yield enough water to make major production wells in these units cost-effective.

Migration of contaminants from the upper to the lower units at these sites has occurred and there is the potential for continued migration. Therefore, the potential for such migration to affect units which currently are not significantly impacted or used was strongly considered by EPA, in conjunction with the direct current water use and State designations for all the hydrostratigraphic units. Because of the potential hydraulic connection between the upper units and the underlying Gage and Lynwood Aquifers, non-potable as well as potable water uses are considered possible in all of the affected units. While there is not evidence that persons have been exposed to groundwater contaminants from these sites, EPA is concerned about preventing future threats to public health and with preserving the groundwater resource.



Not to scale

Figure 7-1
Schematic Presentation of Hydrostratigraphic Units at the Joint Site
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

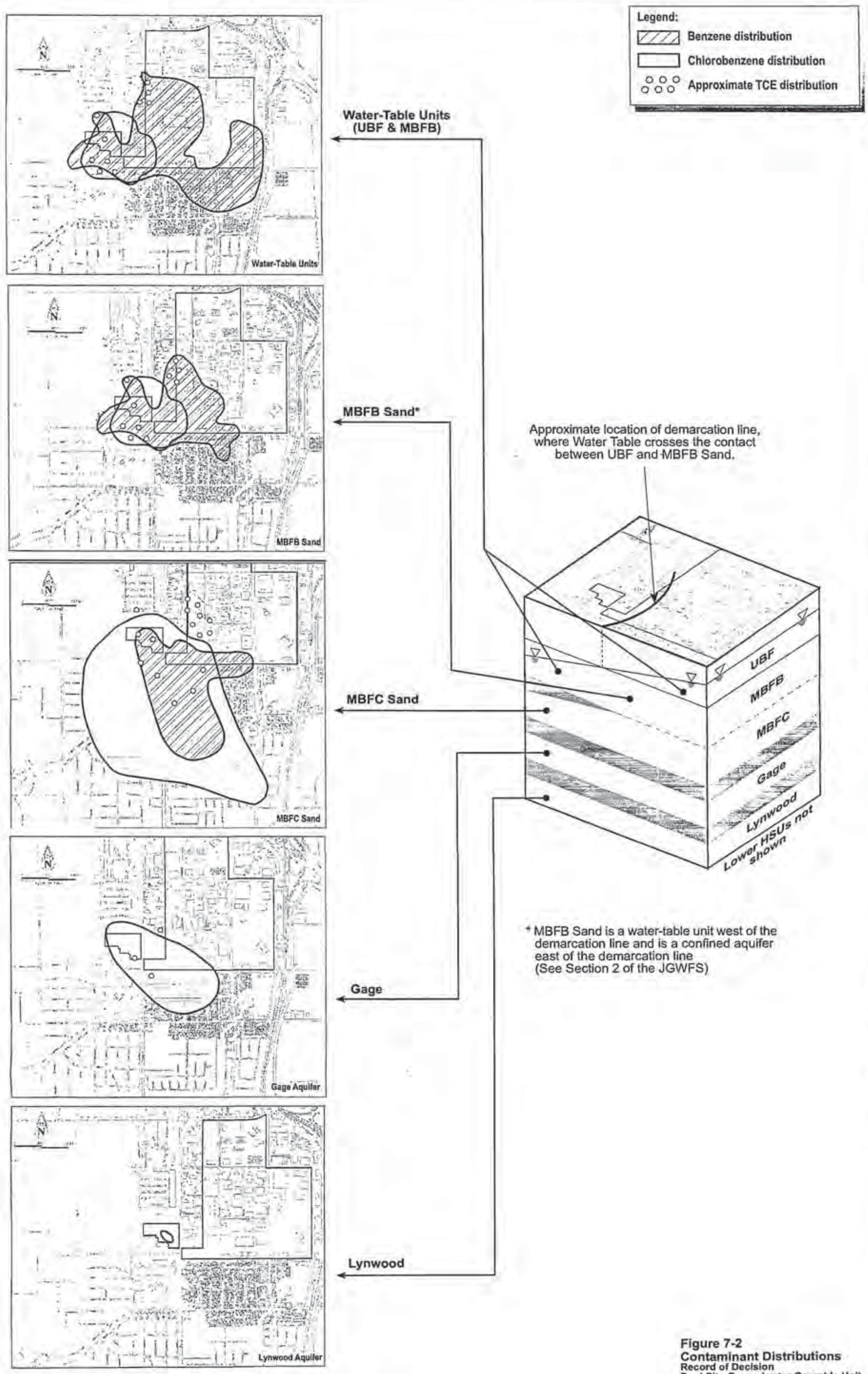


Figure 7-2
Contaminant Distributions
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

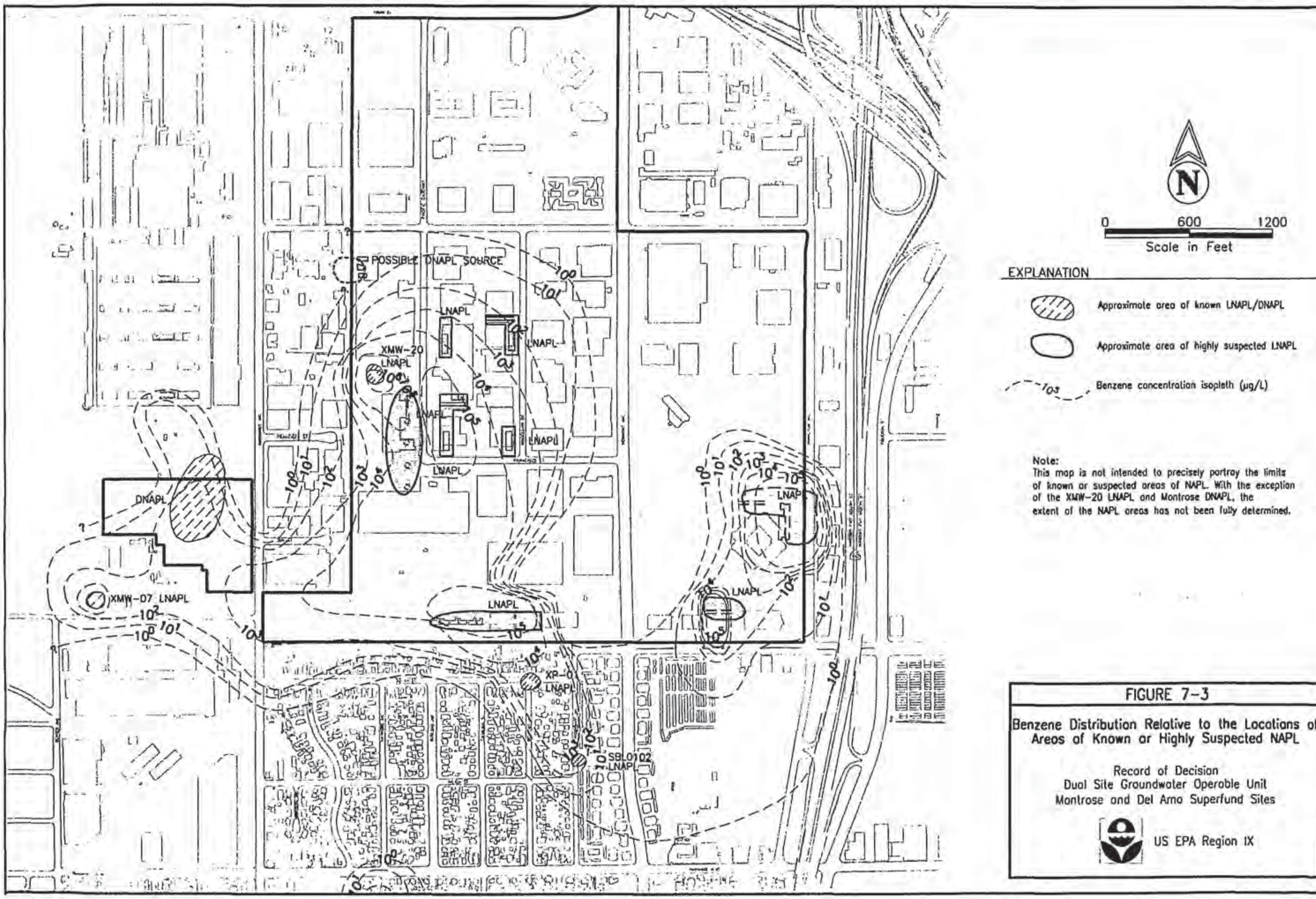
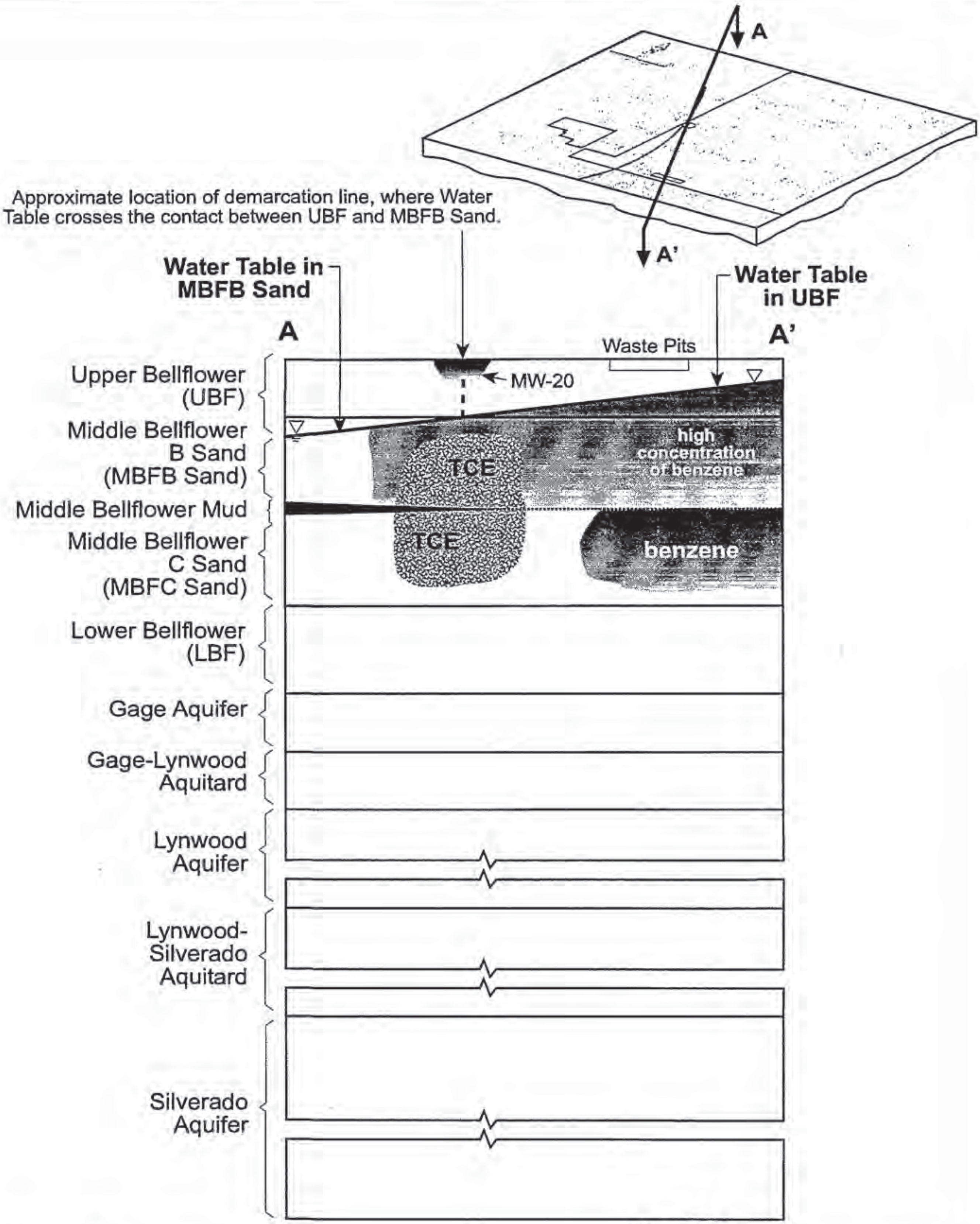


FIGURE 7-3

Benzene Distribution Relative to the Locations of Areas of Known or Highly Suspected NAPL

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

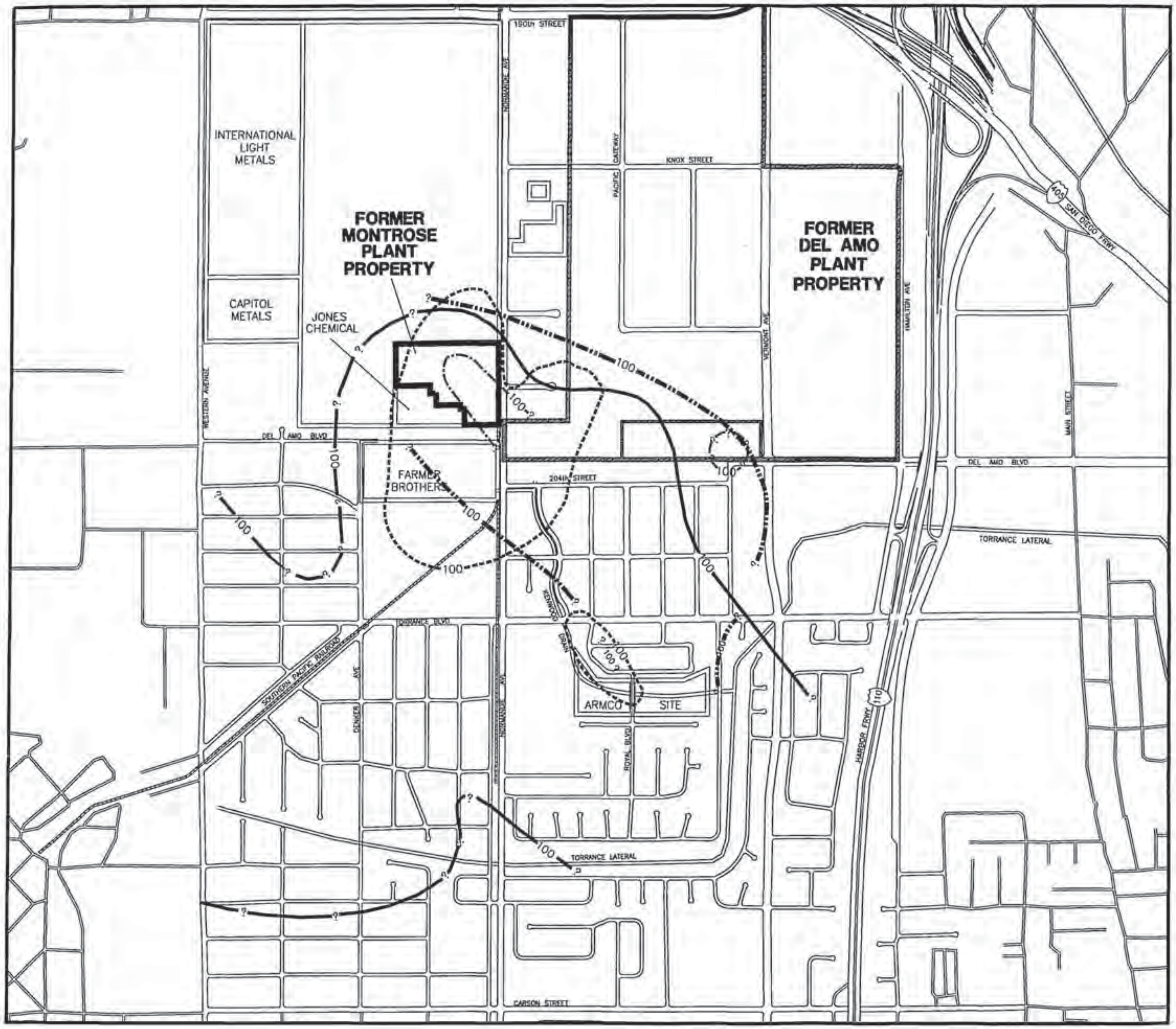


Conceptual Representation

Not to scale

Figure 7-4
TCE Distribution Relative to Benzene
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX



EXPLANATION

BF-05 ⊖ <100 — BELLFLOWER SAND MONITOR WELL; CONCENTRATION IN MICROGRAMS PER LITER

BF-32 — DESTROYED WELL

?———100———? CONTOUR LINE OF EQUAL CONCENTRATION OF PCBSA IN MICROGRAMS PER LITER DASHED WHERE APPROXIMATE, QUERIED WHERE INFERRED

< = LESS THAN; NUMERICAL VALUE IS THE LIMIT OF DETECTION FOR THIS ANALYSIS.

NS = NOT SAMPLED

WELL IDENTIFIER NOTES:
BF = MONTROSE MONITOR WELLS
SWL = DEL AMO MONITOR WELLS

NOTE:
WATER QUALITY DATA PRESENTED ON THIS MAP ARE THE MOST RECENT DATA AVAILABLE FOR EACH WELL AS OF THE FOURTH QUARTER 1995. DATA FOR MONTROSE WELLS WERE SUPPLEMENTED WITH AVAILABLE DATA OBTAINED BY OTHERS FROM NON-MONTROSE MONITOR WELLS LOCATED IN THE SITE VICINITY. SAMPLE DATES RANGE FROM APRIL 1990 TO DECEMBER 1995. SAMPLE DATES AND A SAMPLE RESULTS SUMMARY FOR MONTROSE WELLS ARE PROVIDED IN TABLE 5.5. ANALYTICAL RESULTS FOR ALL ANALYSES FOR MONTROSE WELLS ARE PROVIDED IN APPENDIX G. ANALYTICAL METHODS ARE PROVIDED IN APPENDIX B.

LEGEND

- - - - UPPER BELLFLOWER AQUITARD
——— BELLFLOWER SAND
—··—·· GAGE AQUIFER
—·—·— LYNWOOD AQUIFER

N

0 1000 2000 FEET

FIGURE 7-5

PCBSA DISTRIBUTION IN GROUNDWATER AT CONCENTRATIONS GREATER THAN 100 MICROGRAMS PER LITER RECORD OF DECISION DUAL SITE GROUNDWATER OPERABLE UNIT MONTROSE AND DEL AMO SUPERFUND SITES

US EPA Region IX

PREP BY ______ REV BY ______ RPT NO. ______

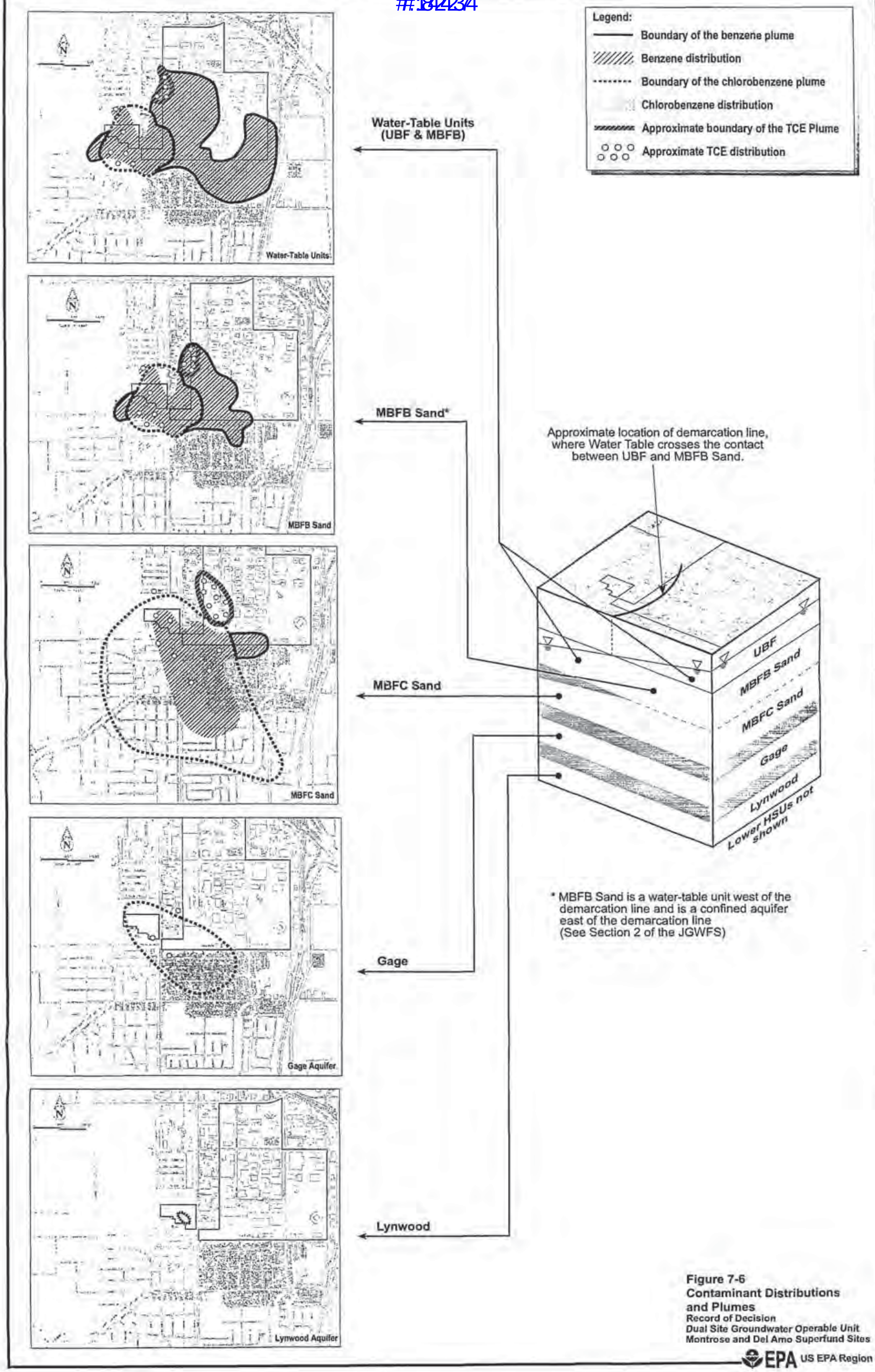


Figure 7-6
Contaminant Distributions and Plumes
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

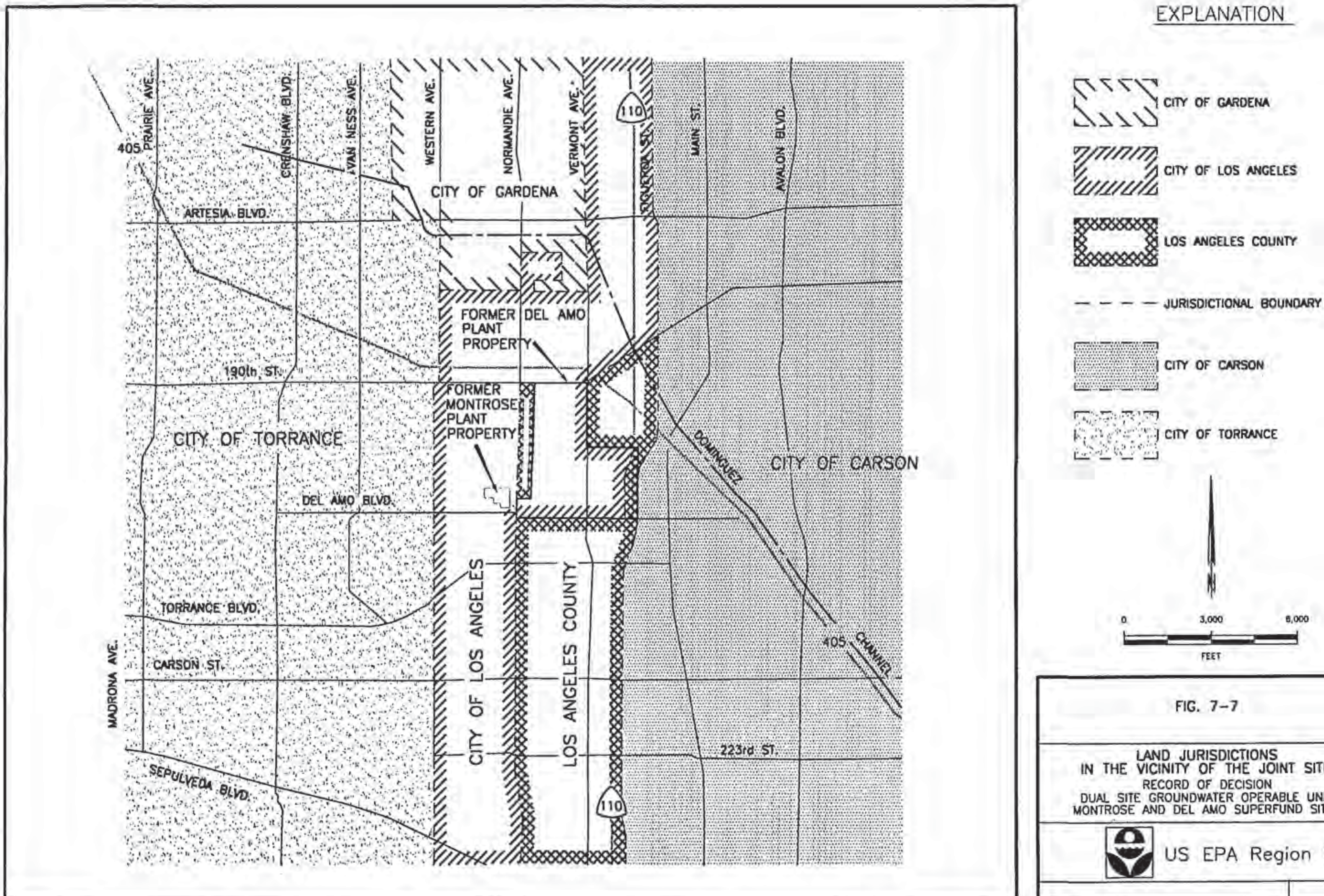


FIG. 7-7

LAND JURISDICTIONS
IN THE VICINITY OF THE JOINT SITE
RECORD OF DECISION
DUAL SITE GROUNDWATER OPERABLE UNIT
MONTROSE AND DEL AMO SUPERFUND SITES

US EPA Region IX

EXPLANATION

- Municipal supply well
- Domestic supply well
- Irrigation supply well
- Domestic/Irrigation supply well
- Industrial supply well
- Remediation/cleanup well
- Observation well
- Well of unknown use

FIGURE 7–8

Wells of Record Within 2–Mile Radius of Study Area

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

8. Summary of Groundwater-Related Risks

To determine the potential health risks associated with contamination at hazardous waste sites, EPA conducts a risk assessment. EPA's risk assessment does not evaluate past exposures or existing health effects. Such exposures and health effects are evaluated by the Federal Agency for Toxic Substances and Disease Registry (ATSDR).

Currently, there is not an immediate *direct* risk from groundwater at the Joint Site because no one is currently drinking the contaminated groundwater and so there is no current exposure to groundwater contaminants. However, EPA's goal is to ensure that actual exposure of people to contaminated groundwater at the Joint Site does not occur. The remedy selected in this ROD is expected to take a minimum of 50 years, and may take significantly longer, to complete. Groundwater use is discussed in Section 7 of this ROD and in Section 2 of the JGWFS. Because there is the potential that contaminated groundwater could be used in the future, EPA's risk assessment evaluates what the risk *would* be *if* someone were to use the groundwater. Such a person could be exposed to contaminants by such activities as ingestion of the water, direct contact, or by inhalation of certain contaminants which volatilize out of the water during showering, toilet flushing, and clothes washing.

Two reports document the risks presuming use of groundwater at the Joint Site. The Joint Groundwater Risk Assessment (JGWRA) was completed by the responsible parties under EPA oversight, and the Supplement to the JGWRA was completed by EPA. Both documents calculate the hypothetical risk to a person who uses the groundwater from a given hydrostratigraphic unit, based on conditions which exist in groundwater today. When evaluating possible remedial actions, EPA typically relies on reasonable maximum exposure (RME) risks, including groundwater uses that result in ingestion, inhalation, and dermal contact. Risks from these pathways have been calculated for each hydrostratigraphic unit. The risk assessment did not focus solely on chlorobenzene, benzene, and TCE, though these do provide the vast majority of the total potential human health risk. Rather, all chemicals in groundwater were considered by the risk assessment documents.

8.1 Two Methods of Risk Characterization: Complexities in Assessing Groundwater Risks

The potential risks (cancer and non-cancer) from Joint Site groundwater have been calculated for this proposed remedy by two methods. The first, used in the JGWRA, utilized a *"plume averaging" approach* in which it was assumed that the receptor was exposed to the average of concentrations measured in monitoring wells in a given hydrostratigraphic unit. The second

method, used in EPA's Supplement to the JGWRA, was to generate *risk contours,* which present a *spatial distribution of risk.* With contours, one can see how the risk to a person placing a single well would vary from point to point in any of the plumes; in effect, how the risk is distributed spatially within the plume.

Neither of these approaches is intended to supersede the other; rather, it is EPA's intention that they be used together to provide a better picture of overall risk for the Joint Site. This two-method approach is indicated due to complexities related to evaluating risks associated with groundwater.

Assessing risks associated with the use of groundwater as a medium is, by most accounts, complex. Among other reasons, this is because groundwater must be drawn from a well or wells before it is used. The concentration of contaminants in the water drawn from the ground (and correspondingly, the risk to an individual using the water) will depend on many factors, including the number of wells being used, the rate at which the water is pumped and the zone of hydraulic influence of the well(s), the depth or depths at which the well is screened to take in water, and changes in the groundwater concentrations over time at the location of the well(s).

To determine what the risk may be to an individual using groundwater, an estimate of the concentration of chemicals in the water that may be used by the individual must be derived. The factors just mentioned complicate the ability to calculate a concentration term that will uniquely represent the exposure to any hypothetical individual. The exact area of groundwater to which a person would be exposed via a well or wells can be difficult to define, and adequate data are not always available for sophisticated risk-based calculations. As with most areas of the field of risk assessment, simplifying assumptions must be made, and these must be acknowledged when interpreting risk calculations.

The description of these methods, and a statement as to the relative drawbacks and benefits of each, is provided in the JGWRA, the Supplement to the JGWRA, and in Section 3 of the JGWFS. The following provides a brief summary of the reasons that EPA supplemented the calculations performed by the plume-averaging approach with risk contours. The JGWRA calculated the concentration term for any given contaminant as the average of concentrations for all wells within the hydrostratigraphic unit for which a risk was being calculated. When used alone, this introduces the following uncertainties and issues:

1. The monitoring wells for the calculation were not installed for the purpose of determining the true average concentration of contaminants in the groundwater, but to determine the extent of the contamination. The result is that the average of concentrations found in all wells is not truly the average concentration in the contaminant distribution;

2. If a person were to use water from a well in the affected groundwater, it is unlikely that their well would produce water with a concentration equal to the average concentration in the overall distribution, unless they were receiving water from a large number of wells within the contaminated area and water was being blended prior to service;

3. Because a single risk value is used to represent the plume, the value cannot reflect information about the spatial distribution of risk within the contaminant distribution in groundwater;

4. The plume-averaging approach cannot take into account the extent of the contaminated area, so that a very large area at medium concentration is computed as having a higher risk than a tiny area at high concentration; and

5. The number of wells used in the calculation varied from hydrostratigraphic unit to unit and the number of wells sampled varied from contaminant to contaminant within each unit.

These issues are more thoroughly discussed in the Supplement to the JGWRA (Section 1).

To mitigate some of these issues with plume-averaged risk, risk contours were developed in the Supplement to the JGWRA. Risk contours are derived from concentration contours, which are interpolated lines of equal concentration derived from sampling results at multiple well points. Each point on the contour is based on an assessment of concentrations at all wells around it. A concentration of a contaminant in groundwater, given an exposure scenario, implies a certain hypothetical risk that can be calculated. Therefore, the continuous spatial distribution of chemical concentrations in groundwater, represented by concentration contours, can be directly translated into a continuous distribution of risk, represented by risk contours. The values of the risk contours for all contaminants can be added to obtain a distribution of total risk within a given hydrostratigraphic unit. By finding the location of a hypothetical future well on such a total risk contour map, one can read an *estimate* of the risk associated with using water from that location, and see how that risk might differ from the risk at any other location in the contaminant distribution.

Risk contouring does not generate a single risk value, but rather a risk distribution that allows one to see the range of risks over the contaminant distribution and to see spatially which areas of the distribution may present particularly high risk or low risk, relative to the other areas. It should be noted that because a given location on a risk contour accounts not only for the concentration from the nearest well but for all wells surrounding that point, risk contouring does not represent "single-point" risk assessment but takes into account all groundwater data available for the Joint Site.

Risk contouring also has uncertainties, including uncertainty in the interpolation to determine contour lines, uncertainty as to the movement of contaminants over time, and uncertainty that the concentration found in monitoring wells would be the same at a production well. However, it is noted that the last two forms of uncertainty also exist for the plume-averaging approach.

The Supplement to the JGWRA produced risk contour sets for the RME exposure scenario in the UBF, MBFB Sand, MBFC Sand, and Gage Aquifer. Because of the small size of the contaminant distribution in the Lynwood Aquifer, it was decided that a risk based on plume- averaged concentrations in this hydrostratigraphic unit would be sufficient and that a risk contour for the Lynwood Aquifer would not add significant value. The JGWRA produced risks based on plume-averaged concentrations as the basis for exposure terms for the MBFB Sand, the MBFC Sand, the Gage Aquifer, and the Lynwood Aquifer, with the exception of the chlorobenzene plume, for which a plume-averaged risk was not computed for the MBFB Sand. EPA did compute a risk contour for this unit, however.

8.2 Summary of Factors for Toxicity Assessment and Exposure Assessment

Cancer potency factors (CPFs) have been developed by EPA's National Center for Exposure Assessment (NCEA) for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of milligram per kilogram per day $(mg/kg/day)^{-1}$, are multiplied by the estimated intake of a carcinogen in mg/kg/day, to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied to account for the use of animal data to predict effects on humans.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects (chemicals may exhibit both carcinogenic and noncarcinogenic effects, in which case EPA accounts for both effects in the risk assessment). RfDs, which are expressed in units of mg/kg/day, are chemical-specific estimates of exposure levels at which noncancer effects would not be expected to occur. Estimated intakes from environmental media can then be compared to the RfD. The ratio of the actual intake to the RfD for a chemical is called the *hazard index* for that chemical. RfDs are derived from human epidemiological studies or animal studies to which safety factors have been applied. These safety factors ensure that the RfDs will not underestimate the potential for noncancer effects to occur.

Of the primary and most prevalent contaminants in groundwater at the Joint Site, benzene, TCE, and PCE are considered potential human carcinogens. Chlorobenzene is not considered a potential human carcinogen but does pose a significant non-cancer risk. The reader should consult the JGWRA for more detailed information on the cancer and noncancer effects of other chemicals in groundwater at the Joint Site.

Both the JGWRA and the Supplement to the JGWRA used the same toxicity and exposure assumptions. However, the JGWRA, utilizing solely the approach of plume-averaging, calculated "average" and "industrial" scenarios of risk as well as the RME scenario. The Supplement, calculating risk contours, provided estimates using only the RME scenario. In the JGWRA, the "average" scenario did not assume upper bound but rather average values for exposure parameters, including concentration. The "industrial scenario" assumed that only workers were exposed during a normal work day. It is noted that the industrial scenario in the JGWRA does *not* represent the risk that would be incurred by a worker using groundwater from directly under the former Montrose or Del Amo plants. Rather, because it uses the average concentration of all wells in the contaminant distribution, it simulates an "average" risk to workers who might use groundwater throughout the entire contaminant distribution. Workers at the former Montrose and Del Amo facilities would experience much higher risks than those represented in the industrial scenario in the JGWRA if they used groundwater from directly under the properties, because the concentrations of contaminants at these locations are at the heart of the distribution, and are extremely high.

The JGWRA and its Supplement considered hypothetical risks from groundwater use at the site by three pathways, including ingestion, inhalation, and dermal contact. The inhalation pathway included activities such as showering, toilet flushing, clothes washing, etc.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g. 10^{-6}). An excess lifetime cancer risk of $1x10^{-6}$ would indicate that, as a plausible upper bound, an individual has a one in one million excess chance of developing cancer as a result of exposure to the contaminants that are the subject of the risk assessment, over a 70-year lifetime under the specific exposure conditions at the site. There are exceptions from site to site, but EPA generally takes remedial actions when the site-related excess cancer risks exceed 10^{-4} and may take action when the site related excess cancer risks are between 10^{-6} and 10^{-4}.

For noncancer risks, the total hazard index for the site is obtained by adding the hazard indices for all contaminants under all pathways. Total hazard indices exceeding unity (1) indicate the possibility for noncancer effects due to the environmental exposures being analyzed in the risk assessment.

8.3 Summary of Risks

Table 8-1 provides a summary of the plume-averaged risks (cancer and noncancer) for the Joint Site by hydrostratigraphic unit. Tables 8-2 and 8-3 provide more detailed breakdowns of the risk at the Joint Site, as calculated by the plume averaging method. These tables breakdown risks by pathway and by plume. Figures 8-1a through 8-1h show the combined risk contours for the Joint Site.

The result of the risk assessment is that the risks from the Joint Site, should anyone use the groundwater, are extremely high. Risks calculated by the plume-averaging method are as much as 12,000 times what EPA would consider a safe concentration for potable use and are above acceptable levels in all of the affected hydrostratigraphic units. Risks at the center of the plumes, calculated by either method, are as much as 100,000 times greater than EPA's point of departure guideline of one in a million excess lifetime cancer risk (10^{-6}) and between 10,000 and 100,000 times greater than the acceptable non-cancer hazard index of 1. Users of water within the Joint Site are not exposed to this contamination presently and such risks would only be realized if the water at the Joint Site were used, either at locations presently affected or after the contamination has spread further.

8.4 Risk Status of para-Chlorobenzene Sulfonic Acid (pCBSA)

pCBSA is a unique by-product of the DDT manufacturing process and is present in high concentrations up to 110,000 ppb downgradient of the Montrose facility at the Joint Site (in the NAPL area directly under the former Montrose plant, concentrations of pCBSA reach 1,100,000 ppb.) pCBSA occurs in all aquifers in which chlorobenzene occurs, and covers a wider lateral area of the aquifers than does chlorobenzene (See discussion in Section 7 of this ROD, Section 2 of the JGWFS, and in the Montrose RI Report, cited in the list in Section 4 of this ROD).

There are no promulgated health-based standards for pCBSA, and there are no accepted toxicological values (slope factor, risk reference dose (RfD), dose-response relationships, etc.) for this compound. In addition, there are no acceptable surrogate compounds upon which to base toxicological values for pCBSA. There are no chronic studies and a few limited acute studies of the toxicity of pCBSA in animals. The few and limited short-term studies, taken alone, provided no indication of mutagenic or teratogenic health effects and suggested that gavage dosages could be raised above 1000 mg/kg/day without observable toxic effects. In addition, another study indicated that another chemical was converted into pCBSA by the body in order to excrete it: pCBSA has a high water solubility. This *may* mean that pCBSA residence time in the human body is short compared to other chemicals at the Joint Site. These factors would suggest a low toxicity. However, the design of the studies performed had definite limitations, and more short-term studies would be needed to confirm these results. More importantly, no chronic (long term)

studies have been done on pCBSA. Therefore, these results are not definitive and cannot be used to quantify the risk associated with pCBSA. In turn, EPA believes there are insufficient data upon which to establish provisional standards for pCBSA. Based on one sub-chronic non-cancer study, the State of California has established with respect to the Joint Site a non-promulgated and provisional No Observed Adverse Effect Level (NOEL) of 1 mg/kg/day for pCBSA, that would approximately translate to a provisional drinking water standard of 25,000 ppb.

EPA intends to monitor any future toxicological studies on pCBSA, however no studies currently are planned. EPA will ensure that the persons making decisions on prioritization of toxicological studies are aware of the presence and nature of pCBSA at the Joint Site.

8.5 Basis for Action

The principal threat for this action, as discussed earlier in this ROD is the NAPL. This NAPL continually and slowly dissolves in the groundwater in any hydrostratigraphic unit in which it is present, creating a distribution of dissolved phase contamination. Also, the NAPL *itself* may move to greater depths.

Through dissolution, the NAPL gives rise to a large distribution of dissolved phase contamination in the groundwater at concentrations in excess of health-based standards. Dissolved contamination may arrive to deeper units either by: (1) dissolved contamination migrating downward from/through the shallower units, or (2) NAPL migrating directly to the deeper unit followed by direct dissolution into the deeper unit. Dissolved contamination also moves outward laterally in most of the affected units. Because of the large extent of existing contamination, and this potential for migration, this contaminated water may eventually be used by persons, may migrate and reach existing wells that are being used for groundwater or reach locations that are the site for future wells, and destroy the usability of the groundwater resource.

This section showed that the health risk posed by the contaminated groundwater at the Joint Site is unacceptable, should the groundwater be used. While the contaminated groundwater at the Joint Site is not being used presently, EPA considered that:

- The groundwater would pose an extreme risk if it were ever used (exceeding 10^{-2} cancer risk and hazard indices in excess of 10,000);
- The groundwater is classified by the State of California as having a potential beneficial use which includes use as drinking water;
- The laws and policies of the State of California are generally focused on protecting potential future beneficial uses of groundwater, even where it is not currently used;
- The NCP requires that EPA consider the potential future uses of groundwater;
- The groundwater is contaminated over a very large area both laterally (covering several square miles) and vertically (covering six hydrostratigraphic units to depths exceeding 200 feet);
- The groundwater contamination may continue to move either as a result of a direct or indirect movement of NAPL or as a result of continued dissolved phase contamination;

- The contamination may move from aquifers or areas which are not presently utilized for drinking water to aquifers or areas which are utilized for drinking water. Protection is necessary for the heavily used Silverado Aquifer which underlies the present extent of contamination at the Joint Site;

- While adjudication may limit the installation of new wells, it does not preclude such installations in the future;

- The groundwater would likely be used to some degree if it were not contaminated, as evidenced by the presence of some wells in the area and plans by cities to install more wells; and

Because of these factors, the risks posed, and the principal threats discussed, EPA considers the groundwater at the Joint Site actionable.

Table 8-1

Summary of Cancer and Non-Cancer Groundwater-Related Risks by the Plume Averaging Method

Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

	Cancer Risk		Non-Cancer Hazard Index	
	Chlorobenzene Plume	**Benzene Plume**	**Chlorobenzene Plume**	**Benzene Plume**
MBFB Sand	Calculated Only By Risk Contours Method	$3x10^{-1}$	Calculated Only By Risk Contour Method	12,724
MBFC Sand	$7x10^{-4}$	$1.3x10^{-1}$	178	9,839
Gage Aquifer	$1x10^{-5}$	*	50	*
Lynwood Aquifer	N/A†	N/A‡	7.2	N/A‡

* The benzene in the Gage Aquifer is in the chlorobenzene plume
† N/A - Not applicable because chlorobenzene is not a carcinogen and other carcinogens are not in the Lynwood
‡ N/A - Not applicable because there is no benzene plume in the Lynwood Aquifer

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND		GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
		Benzene	Chlorobenzene		
Dermal Contact with Tap Water					
Total DDT	NA	0.003	0.046	0.0019	NA
Total BHC	NA	0.00055	0.0089	NA	NA
Acetone	NA	0.0017	0.0010	0.000077	NA
Benzene	600	250	0.074	0.02	NA
sec-Butylbenzene	6	NA	NA	NA	NA
Carbon tetrachloride	NA	0.48	0.095	NA	NA
Chlorobenzene	0.05	0.063	1.4	0.44	0.064
Chloroform	0.2	0.2	0.040	NA	NA
1,4-Dichlorobenzene	NA	0.0083	0.0010	NA	NA
1,1-Dichloroethane	0.004	NA	NA	NA	NA
1,2-Dichloroethane	0.03	NA	NA	NA	NA
1,1-Dichloroethene	0.03	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.02	NA	NA	NA	NA
Ethyl benzene	3	0.94	0.048	0.010	NA
Methylene chloride	0.002	0.0023	0.00040	NA	NA
Naphthalene	0.3	NA	NA	NA	NA
Tetrachloroethylene	1	1.6	0.18	NA	NA
Toluene	0.9	0.15	0.014	0.0033	NA
Trichloroethylene	3	3.0	0.23	NA	NA
Xylenes	0.007	0.0012	0.00027	NA	NA
Arsenic	0.03	NA	NA	NA	NA
Manganese	0.002	NA	NA	NA	NA
Total HI by Pathway	**615**	**256**	**2.1**	**0.47**	**0.064**

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Inhalation of Chemicals from Tap Water					
Total DDT	NA	0.0019	2.5	0.0034	NA
Total BHC	NA	0.0046	0.075	NA	NA
Acetone	NA	0.77	0.44	0.11	NA
Benzene	10,000	8,400	0.48	0.71	NA
sec-Butylbenzene	20	NA	NA	NA	NA
Carbon tetrachloride	NA	32	6.2	NA	NA
Chlorobenzene	4	6.4	144	44	6.4
Chloroform	2	1.8	0.36	NA	NA
1,4-Dichlorobenzene	NA	0.15	0.018	NA	NA
1,1-Dichloroethane	0.4	NA	NA	NA	NA
1,2-Dichloroethane	7	NA	NA	NA	NA
1,1-Dichloroethene	2	NA	NA	NA	NA
cis-1,2-Dichloroethene	3	NA	NA	NA	NA
Ethyl benzene	1	0.35	0.018	0.0039	NA
Methylene chloride	0.04	0.059	0.010	NA	NA
Naphthalene	4	NA	NA	NA	NA
Tetrachloroethylene	4	4.7	0.54	NA	NA
Toluene	2	0.32	0.029	0.0069	NA
Trichloroethylene	20	15	1.2	NA	NA
Xylenes	1	0.018	0.0039	NA	NA
Arsenic	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Total HI by Pathway	**10,070**	**8,462**	**156**	**45**	**6.4**

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Ingestion of Chemicals in Tap Water					
Total DDT	NA	0.0011	0.049	0.0020	NA
Total BHC	NA	0.0018	0.030	NA	NA
Acetone	NA	1.4	0.83	0.064	NA
Benzene	2,000	1,100	0.31	0.86	NA
sec-Butylbenzene	9	NA	NA	NA	NA
Carbon tetrachloride	NA	10	2	NA	NA
Chlorobenzene	0.5	0.72	16	5	0.73
Chloroform	0.7	0.72	0.14	NA	NA
1,4-Dichlorobenzene	NA	0.011	0.0076	NA	NA
1,1-Dichloroethane	0.2	NA	NA	NA	NA
1,2-Dichloroethane	3	NA	NA	NA	NA
1,1-Dichloroethene	0.8	NA	NA	NA	NA
cis-1,2-Dichloroethene	1	NA	NA	NA	NA
Ethyl benzene	2	0.11	0.022	0.0049	NA
Methylene chloride	0.2	0.024	0.042	NA	NA
Naphthalene	2	NA	NA	NA	NA
Tetrachloroethylene	2	1.9	0.23	NA	NA
Toluene	0.4	0.072	0.0065	0.0015	NA
Trichloroethylene	7	6.0	0.47	NA	NA
Xylenes	0.04	0.0072	0.0015	NA	NA
Arsenic	10	NA	NA	NA	NA
Manganese	1	NA	NA	NA	NA
Total HI by Pathway	**2,040**	**1,121**	**20**	**5.9**	**0.73**
Total HI, All Pathways	**12,725**	**9,839**	**178**	**51**	**7.2**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Dermal Contact with Tap Water					
Total DDT	NA	7×10^{-8}	3×10^{-6}	1×10^{-7}	NA
Total BHC	NA	1×10^{-7}	2×10^{-6}	NA	NA
Benzene	2×10^{-2}	9×10^{-3}	3×10^{-6}	8×10^{-7}	NA
Carbon tetrachloride	NA	2×10^{-5}	4×10^{-6}	NA	NA
Chloroform	4×10^{-6}	5×10^{-6}	1×10^{-6}	NA	NA
1,2-Dichloroethane	3×10^{-6}	3×10^{-6}	6×10^{-7}	NA	NA
1,1-Dichloroethene	6×10^{-5}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	2×10^{-5}	2×10^{-6}	NA	NA
Methylene chloride	3×10^{-7}	4×10^{-7}	8×10^{-8}	NA	NA
Tetrachloroethylene	3×10^{-4}	3×10^{-4}	4×10^{-5}	NA	NA
Trichloroethylene	8×10^{-5}	8×10^{-5}	7×10^{-6}	NA	NA
Vinyl Chloride*	8×10^{-5}	NA	NA	NA	NA
Arsenic	5×10^{-6}	NA	NA	NA	NA
Total Cancer Risk by Pathway	**2×10^{-2}**	**9×10^{-3}**	**6×10^{-5}**	**9×10^{-7}**	**NA**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

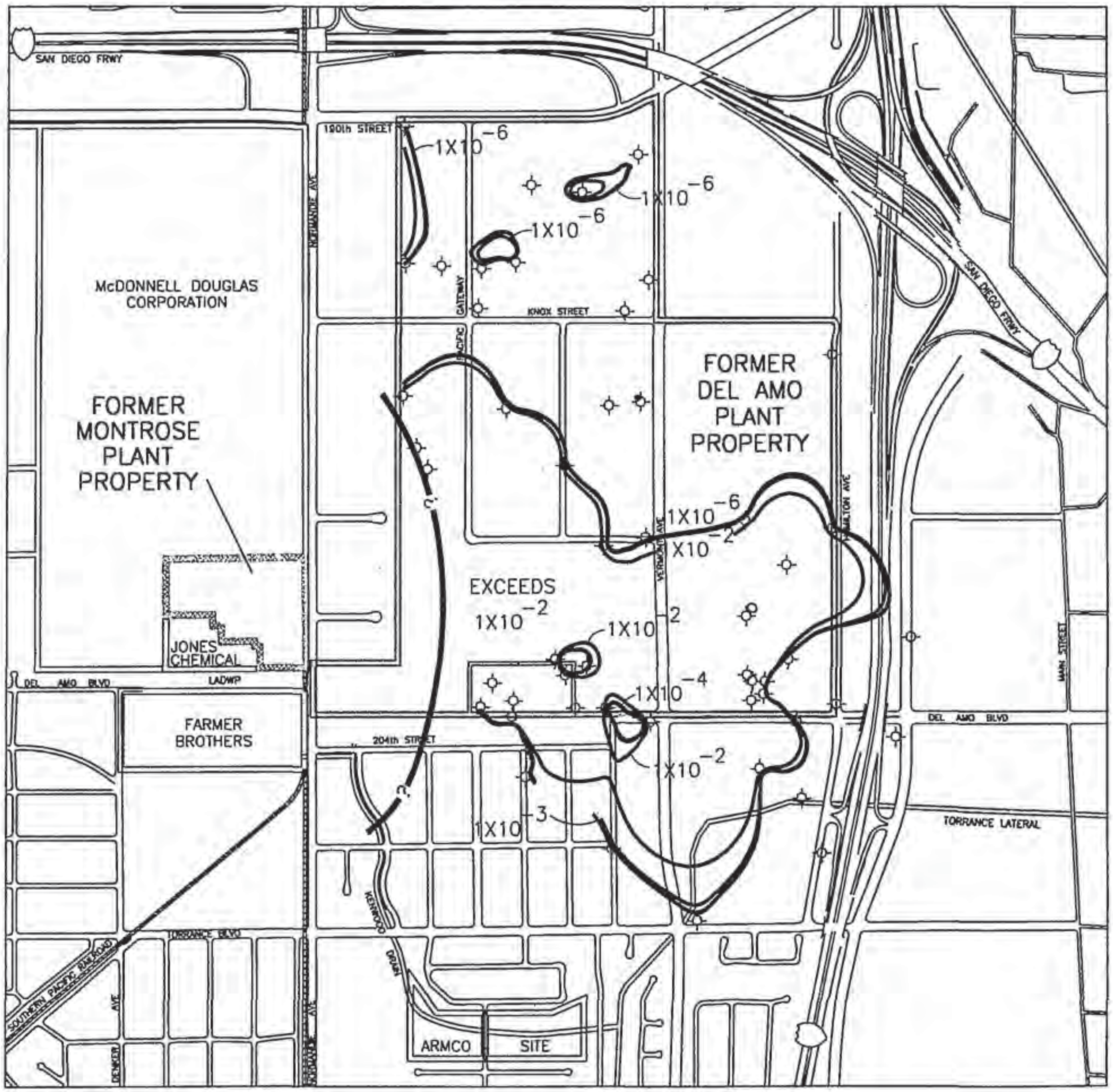
CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Inhalation of Chemicals from Tap Water					
Total DDT	NA	1×10^{-7}	5×10^{-6}	2×10^{-7}	NA
Total BHC	NA	8×10^{-7}	1×10^{-5}	NA	NA
Benzene	2×10^{-1}	8×10^{-2}	2×10^{-5}	8×10^{-6}	NA
Carbon tetrachloride	NA	3×10^{-4}	1×10^{-4}	NA	NA
Chloroform	6×10^{-4}	5×10^{-4}	9×10^{-5}	NA	NA
1,2-Dichloroethane	8×10^{-4}	6×10^{-4}	1×10^{-4}	NA	NA
1,1-Dichloroethene	2×10^{-3}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	3×10^{-4}	3×10^{-5}	NA	NA
Methylene chloride	2×10^{-5}	3×10^{-5}	4×10^{-6}	NA	NA
Tetrachloroethylene	3×10^{-5}	3×10^{-5}	3×10^{-6}	NA	NA
Trichloroethylene	3×10^{-4}	2×10^{-4}	1×10^{-5}	NA	NA
Vinyl Chloride*	6×10^{-4}	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Total Cancer Risk by Pathway	**2×10^{-1}**	**8×10^{-2}**	**4×10^{-4}**	**8×10^{-6}**	**NA**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Ingestion of Chemicals in Water					
Total DDT	NA	8×10^{-8}	4×10^{-6}	1×10^{-7}	NA
Total BHC	NA	4×10^{-7}	7×10^{-6}	NA	NA
Benzene	9×10^{-2}	4×10^{-2}	1×10^{-5}	3×10^{-6}	NA
Carbon tetrachloride	NA	4×10^{-4}	8×10^{-5}	NA	NA
Chloroform	2×10^{-5}	2×10^{-5}	4×10^{-6}	NA	NA
1,2-Dichloroethane	3×10^{-4}	3×10^{-4}	6×10^{-5}	NA	NA
1,1-Dichloroethene	2×10^{-3}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1×10^{-4}	2×10^{-5}	NA	NA
Methylene chloride	4×10^{-5}	5×10^{-5}	8×10^{-6}	NA	NA
Tetrachloroethylene	4×10^{-4}	4×10^{-4}	5×10^{-5}	NA	NA
Trichloroethylene	2×10^{-4}	2×10^{-4}	1×10^{-5}	NA	NA
Vinyl Chloride*	5×10^{-3}	NA	NA	NA	NA
Arsenic	3×10^{-3}	NA	NA	NA	NA
Total Cancer Risk by Pathway	$\mathbf{1 \times 10^{-1}}$	$\mathbf{4 \times 10^{-2}}$	$\mathbf{2 \times 10^{-4}}$	$\mathbf{3 \times 10^{-6}}$	**NA**
Total Cancer Risk, All Pathways	$\mathbf{3 \times 10^{-1}}$	$\mathbf{1 \times 10^{-1}}$	$\mathbf{7 \times 10^{-4}}$	$\mathbf{1 \times 10^{-5}}$	**NA**

*The risk calculation for vinyl chloride does not reflect the most recent guidelines for addressing the impact of vinyl chloride on developing organisms (i.e., children). This "exquisite sensitivity" calculation would result in a vinyl chloride-specific (not overall) risk of up to 10 times the value shown in this table. This calculation was not performed because the risk from all other contaminants is already high, and, even if the vinyl chloride risk were 10 times higher, the overall risk would not be appreciably affected by modifying the calculation. However, the potential impact on vinyl chloride-specific risks is noted.



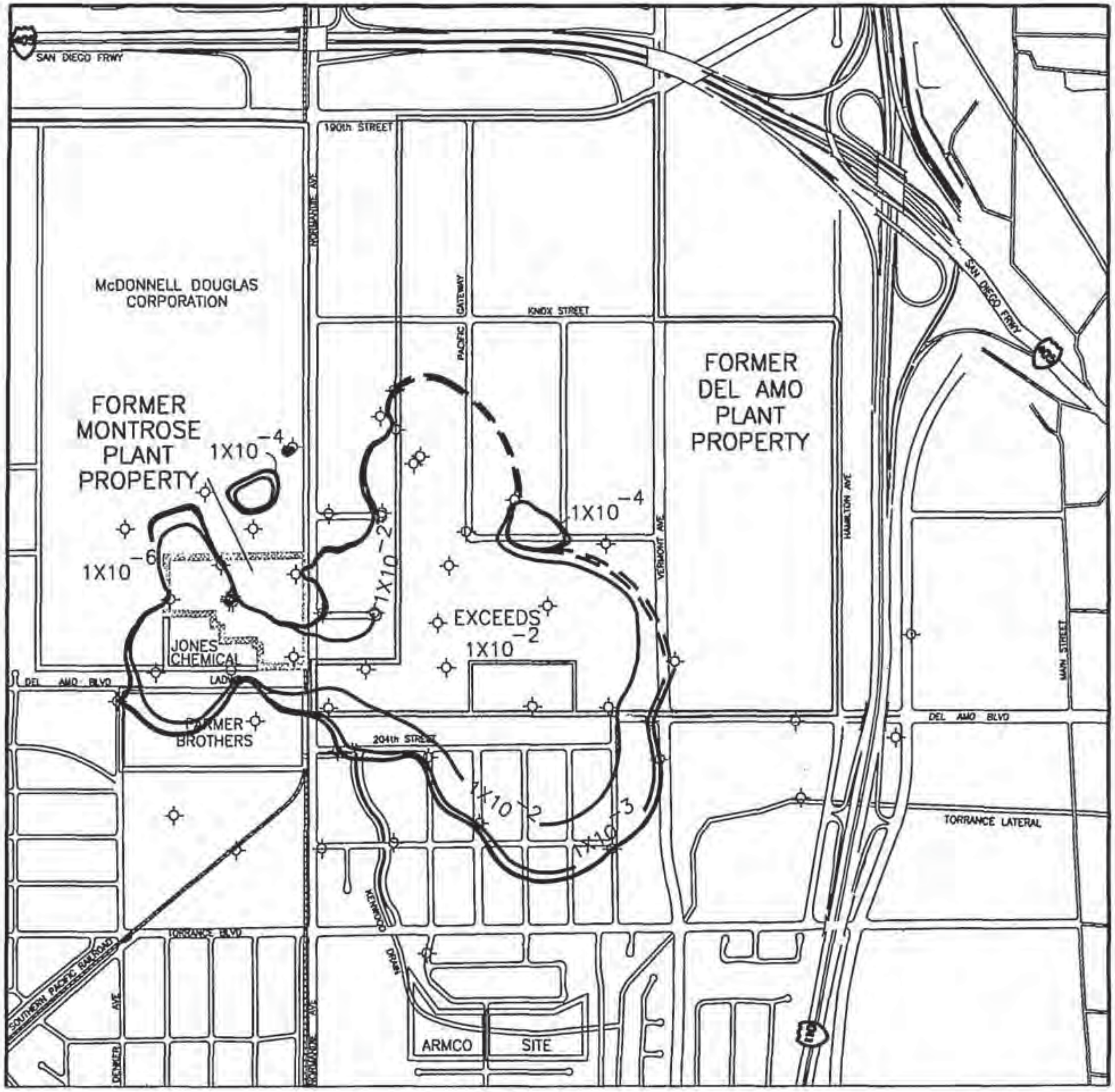
0 1000 2000
SCALE IN FEET

LEGEND:

- Well Location
- ? Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Bellflower aquitard is unsaturated west of the inferred intersection
- $1X10^{-6}$ Risk Isopleth

Figure 8–1a
Total Excess Cancer Risk
Upper Bellflower Aquitord (UBF)
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX



N

0 1000 2000
SCALE IN FEET

LEGEND:

- Well Location
- 1X10^{-2} Risk Isopleth
- 1X10^{-2} Estimated Risk Isopleth

Figure 8–1b
Total Excess Cancer Risk
Middle Bellflower B Sand (MBFB Sand)

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

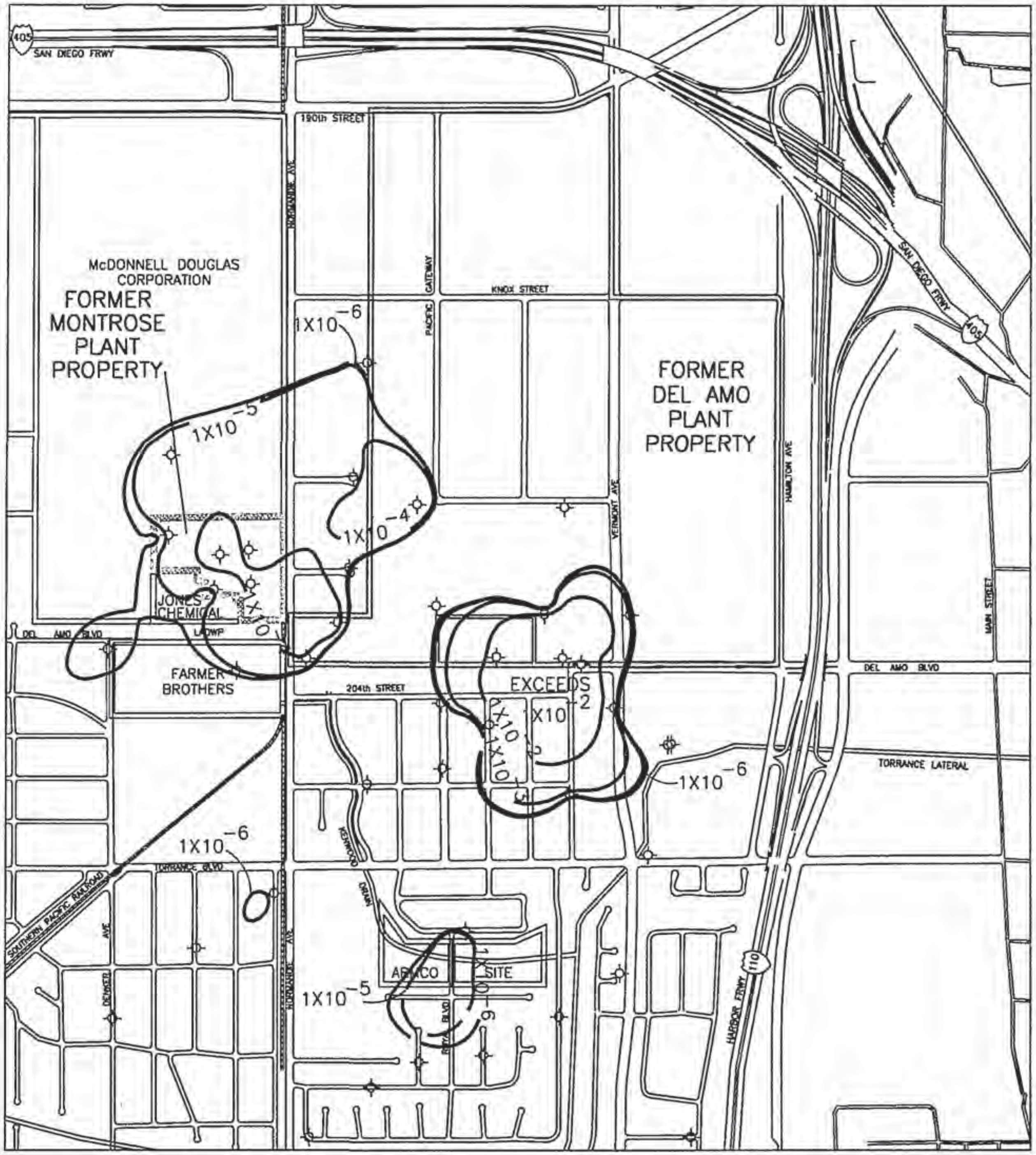


Figure 8–1c
Total Excess Cancer Risk
Middle Bellflower C Sand (MBFC Sand)

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

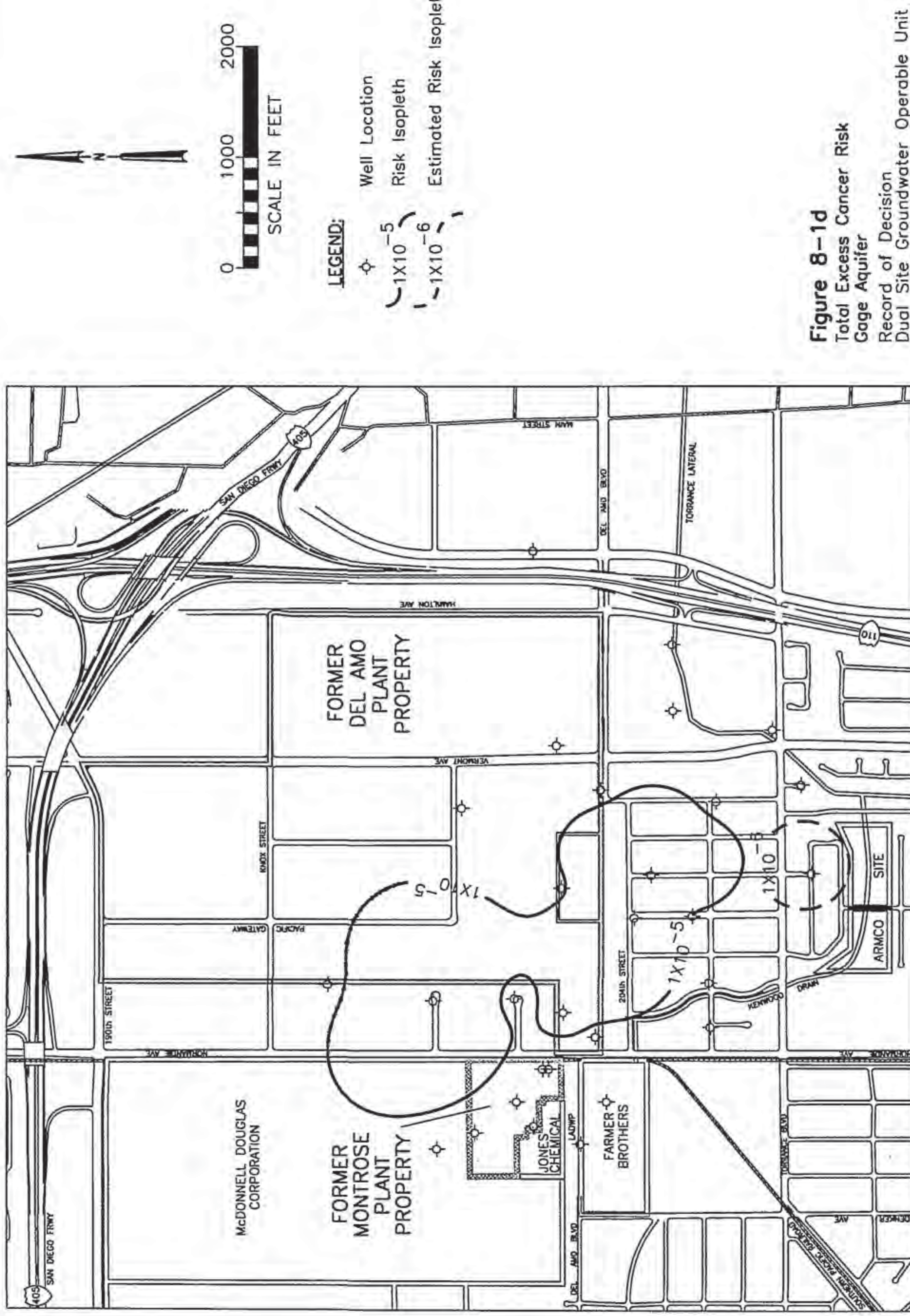
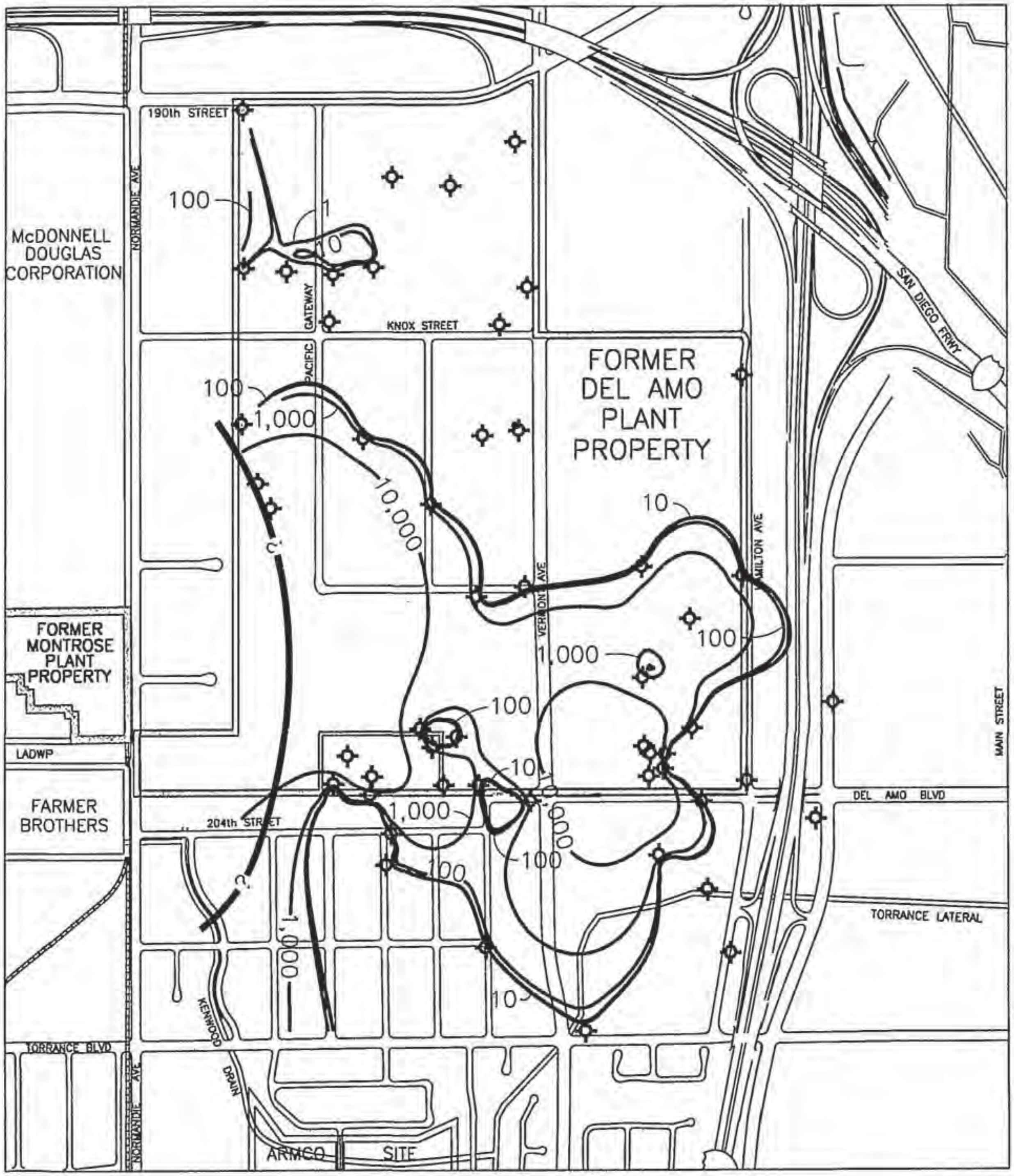


Figure 8–1d
Total Excess Cancer Risk
Gage Aquifer

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX



0 1000 2000
SCALE IN FEET

LEGEND:

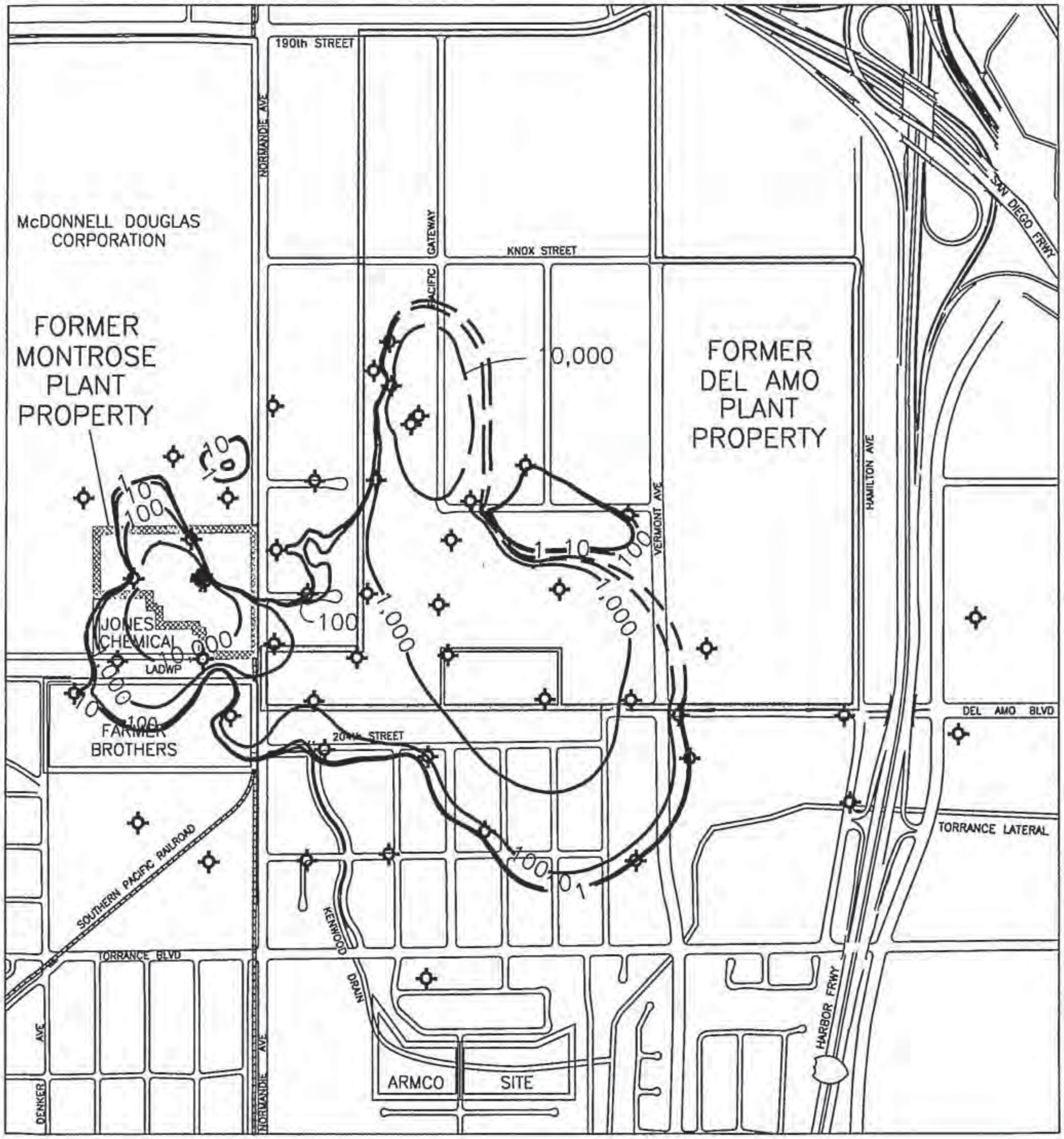
Well Location

Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Bellflower aquitard is unsaturated west of the inferred intersection

1,000 HI Isopleth

Figure 8-1e
Montrose/Del Amo
Total Noncancer Hazard Index
Upper Bellflower Aquitard
(UBF)
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL



N

0 1000 2000
SCALE IN FEET

LEGEND:

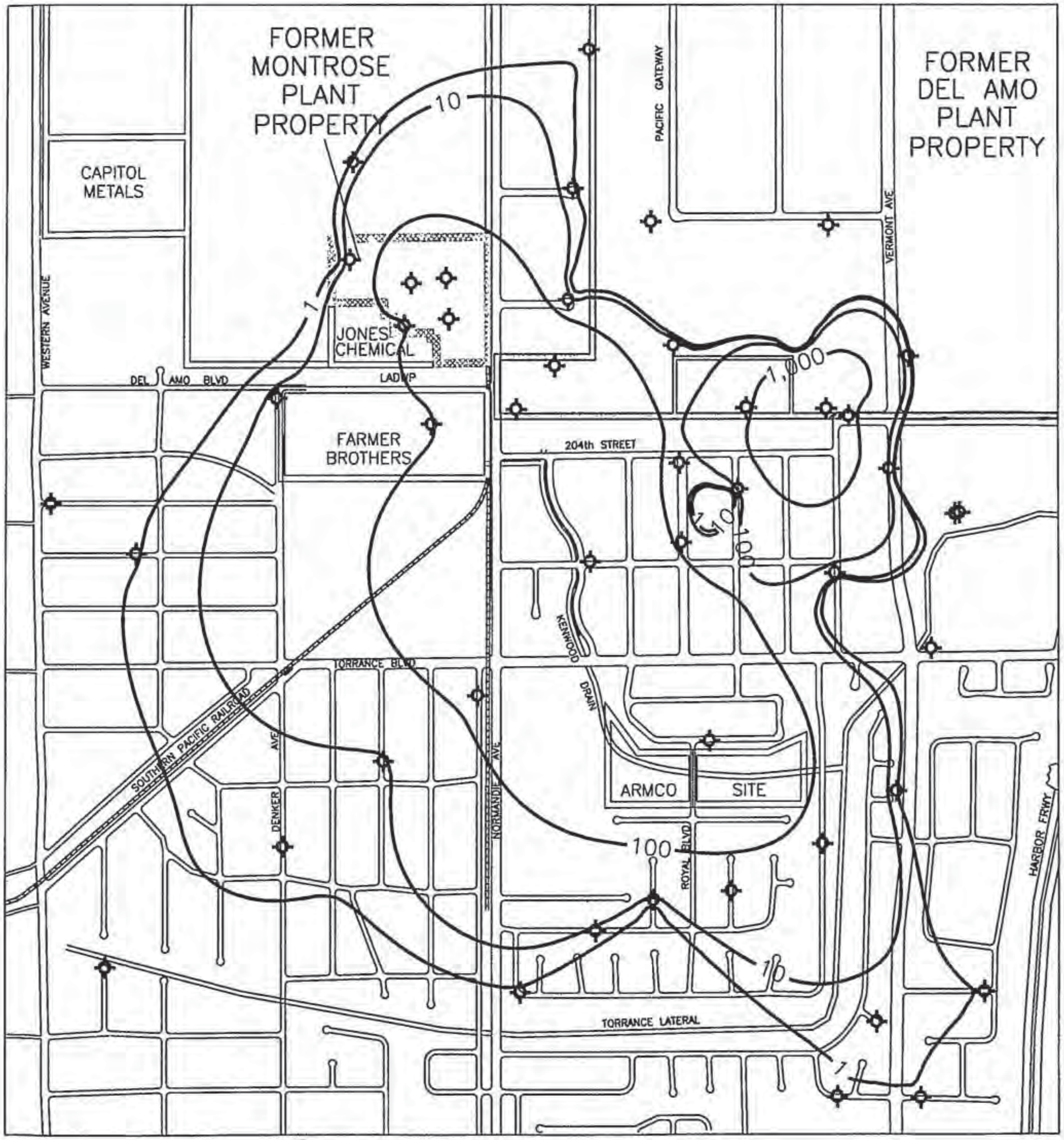
Well Location

1,000 HI Isopleth

10 Estimated HI Isopleth

Figure 8-1f
Montrose/Del Amo
Total Noncancer Hazard Index
Middle Bellflower B Sand
draft
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL



N

0 1000 2000
SCALE IN FEET

LEGEND:
Well Location
1000 HI Isopleth

Figure 8-1g
Montrose/Del Amo
Total Noncancer Hazard Index
Middle Bellflower C Sand
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL

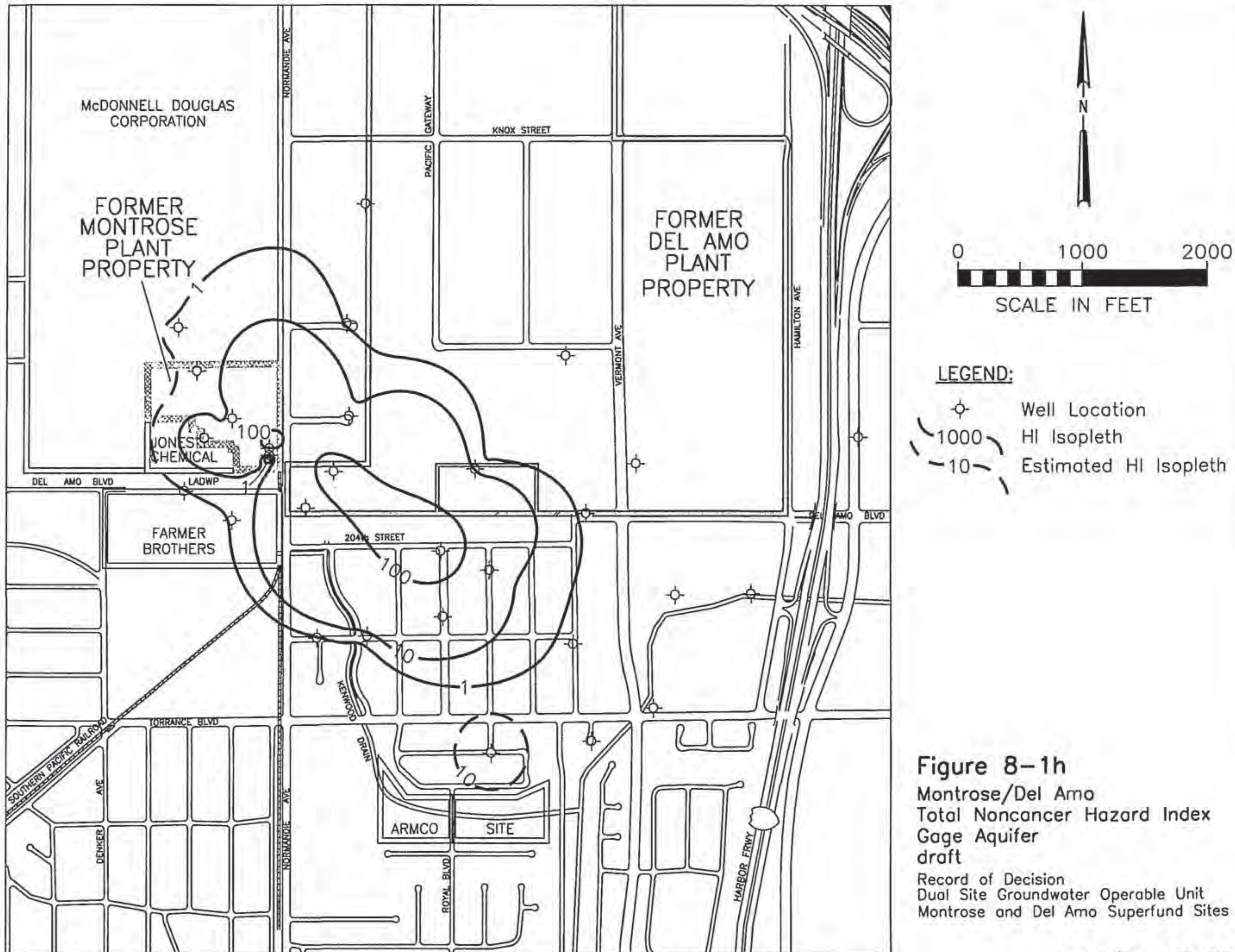


Figure 8–1h
Montrose/Del Amo
Total Noncancer Hazard Index
Gage Aquifer
draft

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL

9. Remedial Action Objectives

The previous sections of this ROD have summarized the nature of the Joint Site, including the presence of NAPL, the distribution and types of contamination, the potential groundwater-related health risks posed by the Joint Site, and the basis for taking action at the Joint Site. This section briefly establishes the remedial action objectives given this information. Sections 10, 11, and 12 discuss and evaluate the basis for a TI waiver and the extent of the containment zone, discuss the factors necessary to understand the remedial alternatives, describe the alternatives, compare the alternatives, and justify the selected alternative. Section 13 presents the remedial action selected in provisional form.

The remedial action objectives for the action selected in this ROD are consistent with both CERCLA and the NCP. As set out in CERCLA, each selected remedial action must:

> "[A]ttain a degree of cleanup of hazardous substances, pollutants and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment..." [42 U.S.C. §9621(d)(1)]; and
>
> Comply with or attain the level of "any standard, requirement, criteria, or limitation under any Federal environmental law" or "any promulgated standard, requirement, criteria or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria or limitation" that is found to be applicable or relevant and appropriate [42 U.S.C. §9621(d)(2)(A)(i)&(ii)].

9.1 In-Situ Groundwater Standards

The particular in-situ concentration for a contaminant which this ROD requires be attained in groundwater at the conclusion of the remedial action shall be referred to by this ROD as the ***in-situ groundwater standard***, or ***ISGS.***

This ROD selects the following:

- The ISGS is the lower (i.e. more stringent) of the federal and State of California Maximum Contaminant Level, or MCL, the drinking water standards promulgated under the Safe Drinking Water Act;
- *Solely* for contaminants for which neither a federal nor a State MCL is promulgated, the ISGS is the EPA Region IX tap water Preliminary Risk Goal (PRG).

The ISGS levels that shall be applied in this remedial action are shown in Table 9-1. This table shows the chemicals detected at the Joint Site, the federal and State MCL where available, the PRG, and the resulting ISGS level[1]. To evaluate the prevalence of detection of most of the chemicals, other than the driving chemicals discussed in Section 7, the reader should consult the Montrose Remedial Investigation Report or the Del Amo Groundwater Remedial Investigation Report.

The selection of the ISGS for each contaminant is determined by applicable or relevant and appropriate requirements, and by the CERCLA requirement that remedies be protective of human health and the environment. This is discussed below.

All groundwater at the Joint Site has been designated by the State of California as having a potential potable beneficial use that would include drinking water [*Water Quality Control Plan, Los Angeles Basin*, California Regional Water Quality Control Board, Los Angeles Region, June 13, 1994; "the Basin Plan"]. When groundwater poses an actual or potential health risk and is a potential drinking water source or could affect a drinking water source, the NCP directs EPA to restore groundwater to federal and State drinking water standards, in a reasonable time frame. The NCP states, at 40 C.F.R. 300.430(a)(1)(iii)(F):

> EPA expects to return usable groundwaters to their beneficial uses whenever possible, within a time frame that is reasonable given the particular circumstances at the site. When restoration of groundwater to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction."

Drinking water standards are considered relevant and appropriate as cleanup standards in-situ in groundwater and are selected by this ROD as Applicable or Relevant and Appropriate Requirements (ARAR; see Appendix A of this ROD) for the remedial action selected by this ROD as per 42 U.S.C. §9621(d)(2)(A)(ii), 40 C.F.R. 300.430(e)(2)(i)(B) and 55 Fed. Reg. 8750-8754 (March 8, 1990). These ARARs are described in Appendix A. The NCP requires the in-situ attainment of the federal or State drinking water standard, whichever is lower. This standard is commonly known as the Maximum Contaminant Level, or MCL. The lower of these two standards for the three most-prevalent Joint Site groundwater contaminants is:

[1]Three sporadically-detected compounds did not have MCL or PRG values. In these cases, EPA has selected reasonable toxicological surrogate compounds (which have similar chemical properties and would be expected to have similar toxicological properties to the compound in question) and EPA has based the ISGS upon the PRG for the surrogate compound. These chemicals were not consistently detected, do not present in a discernable distribution, and provide an insignificant portion of mass and volume of groundwater contamination, as well as the risk posed by the Joint Site groundwater. These compounds are footnoted on Table 9-1.

- 70 parts per billion (ppb) for chlorobenzene;
- 1 ppb for benzene; and
- 5 ppb for TCE.

The value of the PRG is the concentration of the contaminant in groundwater that would pose the lower of a one-in-one-million cancer risk (10^{-6} risk) or a hazard index of unity, assuming standard risk assessment assumptions for residential water use. Solely for chemicals for which no federal or State MCL is promulgated, EPA is selecting the PRG as a remedial action standard to ensure protectiveness of human health and the environment. EPA does not consider PRGs as promulgated cleanup standards, and PRGs are not ARARs. However, it is reasonable to use the PRGs as standards to ensure protectiveness in cases where promulgated standards are not available, because such use is consistent with the NCP provision that 10^{-6} risk and hazard index of 1 should be the point of departure for determining remediation goals [40 C.F.R. 300.430(e)(2)(I)(A)(2)] and the fact that MCLs, when they are promulgated, are usually based on these same levels of risk.

There is an area of groundwater for which attainment of the ISGS is not technically practicable, and the requirement to attain ISGS levels for this groundwater is therefore waived. This is discussed in Section 10 of this ROD.

It is important to make a distinction between *in-situ* cleanup standards, as opposed to *discharge* standards. The former, *in-situ*, means "in place," and refers to the concentration of contaminants which must be attained in the water *in the ground* before the remedial action can be considered complete. The later refers to the concentration of contaminants which must be attained in *treated water* before the water can be discharged under the remedial action. These two are not always the same. ARARs which pertain to EPA's discharge of treated water as a result of this remedial action are identified in Appendix A and further discussed in Section 11 of this ROD.

9.2 Remedial Action Objectives

Remedial objectives apply in addition to the NCP and CERCLA requirement that remedial actions be protective of human health and the environment and attain ARARs in a reasonable time frame. The following remedial action objectives apply to this action.

1. Where technically practicable, reduce the concentrations of contaminants in Joint Site groundwater to ISGS levels;

2. In areas of groundwater where attainment of ISGS levels is not technically practicable, *contain* contaminants within their current lateral extent and depth;

3. Isolate NAPL by surrounding it with a zone of groundwater from which dissolved phase contaminants cannot escape;

4. Prevent lateral and vertical migration of dissolved phase contaminants at concentrations greater than ISGS levels to areas where currently they are not present or are below ISGS levels; and

5. Protect current and future users of groundwater from exposure to Joint Site groundwater contaminants at concentrations above ISGS levels.

In evaluating actions to meet these objectives, EPA has also sought to:

1. Reasonably limit the potential for adverse migration of dissolved phase contaminants and the potential for inducing accelerated movement of NAPL. This refers to the undesired movement of contamination in a manner that would violate or impede the objectives of the remedial action in the long term. This is discussed more fully in Section 11.1 of this ROD.

2. Account for and limit long-term uncertainties over the course of the remedial action. This is further discussed in Section 12 of this ROD.

Table 9-1
In Situ Groundwater Standards (ISGS)
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Compound	Federal MCL (µg/L)	State MCL (µg/L)	EPA 1998 Tap Water PRGs (µg/L) (Listed only when Federal or State MCLs do not exist)	ISGS [1] (µg/L)
Acetone	-	-	610	610
Acrolein	-	-	0.042	0.042
Acrylonitrile	-	-	3.7	3.7
Aldrin	-	-	0.004	0.004
Alpha-BHC	-	-	0.011	0.011
Benzene	5	1	-	1
Beta-BHC	-	-	0.037	0.037
Beta-Endosulfan	-	-	220	220
Bromoform	100	100	-	100
Bromomethane	-	-	8.7	8.7
Di-n-Butyl phthalate	-	-	3700	3700
sec-Butylbenzene	-	-	61	61
Carbon Disulfide	-	-	1,000	1,000
Carbon Tetrachloride	5	0.5	-	0.5
Chlorobenzene	100	70	-	70
Chloroethane	-	-	8600	8600
Chloroform	100	100	-	100
Chloromethane	-	-	1.5	1.5
2-Chlorophenol	-	-	38	38
Cyclohexane	-	-	-[2]	350 [2]
DDD(total)	-	-	0.28	0.28
DDE(total)	-	-	0.20	0.20
DDT(total)	-	-	0.20	0.20
1,2-Dichlorobenzene	600	600	-	600
1,3-Dichlorobenzene	-	-	17	17
1,4-Dicholorobenzene	75	5	-	5
Dichlorobromomethane	100	100	-	100
1,1-Dichloroethane	-	5	-	5
1,2-Dichloroethane	5	0.5	-	0.5
1,1-Dichloroethene	7	6	-	6
cis-1,2-Dichloroethene	70	6	-	6
trans-1,2-Dichloroethene	100	10	-	10
1,2-Dichloropropane	5	5	-	5
Diethylphthalate	-	-	29,000	29,000
Endrin	2	2	-	2
Ethylbenzene	700	700	-	700
Freon 11	-	150	-	150
Freon 12	-	-	390	390
Gamma-BHC	0.2	0.2	-	0.2
Heptachlor	0.4	0.01	-	0.01

Compound	Federal MCL (μg/L)	State MCL (μg/L)	EPA 1998 Tap Water PRGs (μg/L) (Listed only when Federal or State MCLs do not exist)	ISGS [1] (μg/L)
Heptachlor epoxide	0.2	0.01	-	0.01
2-Hexanone	-	-	1604	1604
Isopropylbenzene	-	-	61	61
Methyl Ethyl Ketone	-	-	1900	1900
4-Methyl-2-Pentanone	-	-	160	160
Methylene Chloride	5	5	-	5
2-Methylnaphthalene	-	-	- [3]	6.2 [3]
Naphthalene	-	-	6.2	6.2
Pentachlorophenol	1	1	-	1
Phenol	-	-	22,000	22,000
n-Propylbenzene	-	-	61	61
Styrene	100	100	-	100
1,1,2,2-Tetrachloroethane	-	1	-	1
Tetrachloroethene	5	5	-	5
Toluene	1,000	150	-	150
1,2,4-Trichlorobenzene	70	70	-	70
1,1,1-Trichloroethane	200	200	-	200
1,1,2-Trichloroethane	5	5	-	5
Trichloroethene	5	5	-	5
1,2,4-Trimethylbenzene	-	-	12	12
Vinyl Acetate	-	-	410	410
Vinyl Chloride	2	0.5	-	0.5
Xylenes (total)	10,000	1,750	-	1,750

Notes:

1- The In Situ Groundwater Standard for each chemical detected is the more stringent of the federal and state MCL where these exist. Solely for chemicals with no state or federal MCL promulgated, the ISGS is the EPA May 7, 1998 tap water PRG.

2- There is no MCL or PRG available for cyclohexane. The ISGS value is based on the PRG for n-Hexane, which is used as a surrogate compound for cyclohexane.

3- There is no MCL or PRG available for 2-Methylnaphthalene. The ISGS value is based on the PRG for Naphthalene, which is used as a surrogate compound for 2-Methylnapthalene.

4- There is no MCL or PRG available for 2-Hexanone. The ISGS value is based on the PRG for Methyl Isobutyl Ketone, which is used as a surrogate component for 2-Hexanone.

2-4: Toxicological surrogate compounds would be expected to have similar toxicological properties to the compounds in question. The three contaminants noted were not consistently detected, do not present in a discernable distribution, and provide an insignificant portion of mass and volume of groundwater contamination, as well as the risk posed by the Joint Site groundwater.

10. Technical Impracticability Waiver and Containment Zone

10.1 Introduction and Provisions

This ROD issues a waiver of the requirement to attain ISGS levels, and other ARARs identified in Appendix A of this ROD, based on the technical impracticability of cleaning groundwater to ISGS levels. This waiver is issued pursuant to 42 U.S.C. §9621(d)(4)(C) and 40 C.F.R.-300.430(f)(1)(ii)(C)(3). This waiver shall apply solely to a region of groundwater defined in this section, which is called the TI waiver zone and containment zone, depending on the context, as discussed below.

EPA has recognized that much of the groundwater at the Joint Site can be restored to ISGS levels. In order to do so, a zone of dissolved phase contamination in groundwater surrounding the NAPL must be contained, thereby isolating the NAPL. This zone is called the ***containment zone***[1]. If this is achieved, dissolved contamination from the NAPL cannot reach the water outside the containment zone, and so the outside groundwater can then be cleaned to ISGS levels. It is technically impracticable to attain ISGS levels *inside* the containment zone, because the NAPL continues to dissolve into groundwater there. By establishing a containment zone, the greatest possible extent of the groundwater can be restored to concentrations below ISGS levels, in keeping with the requirements of the NCP. As specified in Section 9, the objective for water inside the containment zone is containment; the objective for groundwater outside the containment zone is restoration to ISGS levels.

Because it is technically impracticable to attain ISGS levels *inside* the containment zone, this same physical space is also referred to as the ***TI waiver zone***. Groundwater outside the TI waiver zone is not subject to the waiver, and all ARARs identified in Appendix A remain in force there. Issuance of a TI waiver does not preclude that other standards or remedial actions apply to the contamination within the TI waiver zone in lieu of the particular requirements that are waived.

Figure 10-1 shows the TI waiver zone for the Joint Site in each hydrostratigraphic unit. In the chlorobenzene plume, the lateral extent of the proposed TI waiver zone is based on safely containing the DNAPL, and extends vertically through the Gage Aquifer. It does not include the Lynwood Aquifer or the Gage-Lynwood Aquitard. In the benzene and TCE plumes, the TI waiver zone extends vertically through the MBFC Sand. It does not include the Lower Bellflower

[1]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

Aquitard. The lateral extent of the TI waiver zone for the benzene and TCE plumes is based on differing factors, depending on the hydrostratigraphic unit. This is fully discussed below.

EPA has utilized, as appropriate, the *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration*, (U.S. EPA OSWER Directive 9234.2-25, October 1993). The presence of NAPL alone generally is not sufficient to justify a TI waiver. EPA guidance directs that a TI waiver be justified based on site-specific conditions. The guidance directs that EPA's justification of a TI waiver include the following elements, among others:

- The specific ARARs or media cleanup standards for which TI determinations are being made;
- The spatial area over which the TI decision will apply;
- The conceptual model which describes site geology, hydrology, groundwater contamination sources, transport, and fate;
- An evaluation of the restoration potential of the area to be subject to the TI waiver, including data and analyses that support the assertion that attainment of ARARs or media cleanup standards is technically impracticable from an engineering perspective;
- Any additional information or analyses that EPA deems necessary for the TI evaluation.

Appendix E of the JGWFS provides such justification in detail for the Joint Site. The following section serves only to summarize and provide highlights. This section also summarizes EPA's basis for selecting the size and location of the TI waiver zone in each of the hydrostratigraphic units.

EPA has <u>not</u> made a determination that <u>no</u> NAPL can or shall be removed from either the Montrose or the Del Amo Superfund sites. This ROD, in issuing this TI waiver, determines solely that existing technologies will be incapable of practicably recovering enough NAPL (essentially all of it) to attain ISGS levels at <u>all</u> points in groundwater. Hence, a waiver of the requirement to attain the ISGS must be issued for a portion of the groundwater surrounding the NAPL. This determination leaves open the broader determination as to whether and to what degree NAPL recovery or immobilization will occur at the Montrose Chemical and Del Amo Superfund sites. As previously established by this ROD, a second phase of this groundwater operable unit shall address this matter. Future remedial actions to address NAPL recovery or immobilization will be addressed by amendment(s) to this ROD (See Declaration and Section 4 of this ROD). There are many technologies which would be capable of recovering some of the NAPL from the ground at

either site. It is noted that the TI waiver guidance cited above also directs EPA to demonstrate "that contamination sources [NAPL] have been identified and have been, or will be, removed and contained to the extent practicable." EPA's second phase of remedy selection addresses this guidance provision.

10.2 Summary of Why NAPL Areas Cannot Be Restored to Drinking Water Standards

NAPL is known as one of the most challenging and recalcitrant of all Superfund problems. As already discussed, while in most cases there are technologies that can remove some NAPL, it is often necessary to remove virtually all NAPL before concentrations in groundwater near the NAPL can approach concentrations commensurate with ISGS levels. Presently, there are no technologies, which have been proven to be capable of removing *all* NAPL from large sites where NAPL is widely distributed laterally and vertically, and where stratigraphy is highly heterogeneous and complex.

At the Montrose Chemical Site, the soils are highly heterogeneous. DNAPL has migrated downward to great depths, potentially exceeding 130 feet below land surface, which correspond to the bottom of the MBFC Sand and the Gage Aquifer. DNAPL beneath the Montrose Chemical Site occurs in discontinuous thin layers that likely reside atop the heterogeneously distributed fine-grained sediments. The majority of the DNAPL is below the water table. The DNAPL relative saturation distribution has not been determined, and it is impracticable to do this to a highly accurate degree. Montrose Chemical Company is continuing, under EPA oversight, to evaluate the properties and distribution of DNAPL, and evaluate options for removing some DNAPL. However, it will not be practicable to remove enough (virtually all) DNAPL so as to attain drinking water standards in the immediate vicinity of the DNAPL.

At the Del Amo Site, there is also substantial heterogeneity in the soils. Although NAPL at the former Del Amo plant property consists primarily of benzene, and therefore is lighter than water (LNAPL), beneath the site it is primarily smeared below the water table. This distribution of LNAPL beneath the former Del Amo plant property is the result of low water levels at the time of the LNAPL release and subsequent rise of the water table for about the past 30 years. The LNAPL that has been located and subjected to extensive testing appears to be present at low (below residual) saturations. Therefore, the studied NAPL appears to be present primarily in ganglia and droplets held in pore spaces by capillary forces. The former Del Amo plant site also presents an additional complication of having many multiple sources of LNAPL which are located relatively close to each other. A region of dissolved-phase contamination surrounds *each* of these sources, but because of their mutual proximity, these regions overlap in a largely contiguous distribution. Thus, removal of virtually all the LNAPL would have to occur in all of the multiple areas before drinking water standards could be achieved. There remain some locations where NAPL may be present at higher residual saturations. As with respect to the Montrose Chemical

Site, Shell and Dow are working under EPA oversight to further evaluate options for removing some of this LNAPL. However, it will not be practicable to remove enough of the LNAPL to attain drinking water standards.

The reduction in concentration of dissolved contaminants to ISGS levels is not practicable in the groundwater surrounding the multiple LNAPL sources located at the Del Amo Site because (1) removal of the NAPL sources is not technically practicable, (2) restoration could never be complete due to the continuing migration of benzene from the LNAPL sources; (3) extraction wells in the fine-grained UBF and MBFB would have extremely small radii of influence, which would necessitate impractically large numbers of wells needed to capture and remove contaminated groundwater; and (4) the removal of the dissolved contamination in the MBFC, directly underneath the LNAPL is not practicable because it could cause adverse downward migration of contaminants from the overlying LNAPL sources, which will prevent the restoration this portion of the MBFC to ISGS (See Appendix E of the JGWFS).

Significantly more detail on this argument is provided in Appendix E of the JGWFS.

10.3 Non-NAPL Contaminants in the TI Waiver Zone

Where TI waivers are applied, the waiver is applied to *all* chemicals within the TI waiver zone, regardless of whether all of the chemicals served to base the original justification for the waiver. For example, if there is a TI waiver zone due to benzene as NAPL, all other contaminants in the same zone that are not present as NAPL would also be subject to the waiver.

Attempting to restore an incidental contaminant to ISGS levels that is present only in the dissolved phase within the TI waiver zone would impose the same remedial actions on the TI waiver zone that are otherwise waived due to the contaminant that is present in the NAPL phase. It would not be practicable, for instance, to apply hydraulic extraction and treatment to reduce dissolved naphthalene to ISGS levels, while the same water would also contain exceedingly high dissolved phase concentrations of benzene, which would not be reducible due to the presence of benzene NAPL. Such high concentrations of NAPL contaminant would dominate the capacity of the treatment technology, prohibiting reductions of dissolved naphthalene to ISGS levels. Second, such actions might induce adverse movements of high-concentration dissolved benzene or chlorobenzene contamination into areas where it is not currently present, and/or downward migration of DNAPL at the Montrose Chemical Site. Finally, it does not provide a significant environmental benefit, in this case, to attempt to remove the incidental dissolved phase contaminants, when the contaminants which serve as the primary risk drivers are also present as NAPL and will remain indefinitely within the TI waiver zone at exceedingly high concentrations.

10.4 Extent and Configuration of the TI Waiver Zone

In addition to establishing the need for a containment zone, this ROD also establishes the extent and configuration of the zone. The containment zone selected by this ROD differs in extent and configuration, depending on the plume and the hydrostratigraphic unit in question. EPA has based this selection on a set of consistent principles. EPA intended that the extent and configuration of the TI waiver zone should:

- Have a supportable technical basis;
- Be as small as reasonably possible while still meeting all objectives of the remedial action;
- Allow for limiting the potential for adverse migration of NAPL;
- Allow for limiting the potential for adverse migration of dissolved phase contamination;
- Allow for maximum efficiency in monitoring and assessing compliance with the requirement of containing contamination within the TI waiver zone;
- Avoid complicating the remedial action, its design, and implementation to the point that implementability is compromised or questionable; and
- Eliminate the potential for requiring remedial actions, which would provide no tangible environmental or protective benefit.

The first two principles arise from the fact that the TI waiver zone applies by definition to the groundwater for which it is truly impracticable to attain ISGS levels in a reasonable time frame. By corollary, in accordance with the NCP with EPA guidance on TI waivers, and with consideration to State of California Water Resources Control Board Resolution 92-49(H) [a.k.a. "Containment Zone Policy, which contains a provision that containment zones be kept as small as possible], it is EPA's intention to attain ISGS levels for the greatest practicable extent of groundwater. EPA did not extend the TI waiver zone beyond the reasonable technical basis for its existence.

EPA rejected assorted arguments informally suggested during the feasibility study process that the TI waiver zone should be extended to contain the entire contaminant distribution, more than a mile from the former plant properties and affecting six hydrostratigraphic units. This clearly would have been an inappropriate use of a TI waiver because, regardless of any relative difficulties or risks which might exist in attempting to restore groundwater in the downgradient portions of the plume, it *is* technically practicable to do so and to do so without compromising the objectives of the remedial action (e.g. inducing significant adverse downward movements of

NAPL). It is the NAPL which is the foundation of and gives rise to the TI waiver zone in this case; broad extension of the TI waiver zone outside the area of NAPL and potential influence on NAPL would not be appropriate.

At the same time, the second principle states that the TI waiver zone is to be as small as possible, *provided that all objectives of the remedial action can still be obtained*. This second phrase is also important to EPA's selection of the extent and configuration of the TI waiver zone. Most of the principles following the second principle arise from this consideration. In making this selection, EPA has placed "technically impracticable" within the context of all objectives of the remedial action, the attainment of which lead to the protection of human health and the environment. There are areas of groundwater within the Joint Site which, in the strictest sense, could potentially be restored to ISGS concentrations, at least temporarily. However, it would *not* be technically practicable to do so without compromising other basic objectives of the remedial action. Such areas are, therefore, included in the TI waiver zone. In keeping with the second principle, these areas have been kept as small as reasonably possible.

The evaluation of the lateral extent of the TI waiver zone and the means of containment of contaminants within this zone were made separately for each contaminant plume in each hydrostratigraphic unit. However, because the LNAPL and DNAPL TI waiver zones largely overlapped when evaluated separately EPA has established a single TI waiver zone for the Joint Site as the union of these two zones in each hydrostratigraphic unit. The technical factors accounted for by EPA in this evaluation include (1) physical processes affecting migration of contaminants, (2) the hydrostratigraphic conditions of the affected units, and (3) the amount and quality of data being used in any given hydrostratigraphic unit in the JGWFS groundwater model (See Section 11.1), and hence the degree of certainty/usability of the model on a case-specific basis. The basis for the TI waiver zone is discussed briefly below for the chlorobenzene, benzene, and TCE plumes.

Chlorobenzene Plume

The portion of the containment zone/TI waiver zone that lies within the chlorobenzene plume is larger than the extent of NAPL itself (i.e., includes portions of the dissolved plumes immediately adjacent to NAPL). The reason for this and the basis used to determine extent of this portion of the TI waiver zone is discussed below and in Appendix E of the JGWFS.

As determined in the JGWFS, and discussed in Section 11.1 of this ROD, active hydraulic extraction and treatment (pumping) is the sole effective means by which the dissolved contamination surrounding the DNAPL at the former Montrose plant property is contained (thereby isolating the DNAPL source). Therefore, EPA considered the implications of such pumping in determining the size of the part of the containment zone that lies in the chlorobenzene plume. The alternatives modeled for this remedial action were developed so as to ensure that

DNAPL would not be mobilized by the hydraulic extraction that creates the containment zone. The minimum necessary distance downgradient of the DNAPL at which to place containment wells so as safely limit drawdown in the DNAPL area was evaluated using a groundwater model (discussed in Section 11.1). Using this approach, the containment zone within the chlorobenzene plume is determined to be the minimum area that allows for hydraulic containment of DNAPL without adversely affecting DNAPL migration. This zone is larger than the area where DNAPL actually occurs. The containment zone must be subject to the TI waiver, because the DNAPL remaining inside the containment zone continuously contaminates any water that is within the zone.

Vertically, the TI waiver zone in the chlorobenzene plume extends to the Gage Aquifer. The best information available indicates this is the depth to which DNAPL may have migrated. It is noted that direct and certain identification of NAPL at the depth of the Gage Aquifer, and finding the greatest depth to which NAPL has migrated, are extremely difficult in this type of heterogeneous environment. However, dissolved and sorbed phase concentrations in both the MBFC Sand and the Gage Aquifer are high enough to be indicative of the likely presence of NAPL. It is important to note that the TI waiver zone does not extend to the Gage-Lynwood Aquitard and Lynwood Aquifer; the area of chlorobenzene contamination in the Lynwood Aquifer shall be restored to ISGS levels.

The majority of the chlorobenzene plume lies outside the TI waiver zone. (Section 2 and Appendix E of the JGWFS). The plume of dissolved contaminants extends more than 1.3 miles from the former Montrose plant in the MBFC Sand and as much as a mile in the Gage Aquifer, and vertically occurs as deep as in the Lynwood Aquifer. Based on the results of the JGWFS, it is feasible to restore the area of the chlorobenzene contamination to ISGS levels (e.g. drinking water standards) outside the TI waiver zone, and such a reduction would have an effect on concentration, mass, future contaminant migration, and risk reduction of the chlorobenzene plume.

Benzene Plume in the UBF and MBFB Sand

This discussion pertains only to the benzene plume in the first two units, the UBF and the MBFB Sand. The water table occurs in one of these units, depending on the location within the Joint Site. (See Section 7, "Summary of Site Characteristics," or the JGWFS, or the Remedial Investigation Reports). Again note the definition of plumes used by this ROD (See "Conventions for Dividing the Contamination into Plumes," in Section 7.2 of this ROD). As with the TI waiver zone in the chlorobenzene plume, the size of the TI waiver zone in the benzene and TCE plumes in these units is somewhat larger than the actual NAPL distribution. The basis for this is discussed in the course of the discussion below.

Basis for Not Establishing Multiple TI Waiver Zones in These Units

As previously discussed, the benzene plume in these units is characterized by a large number of multiple residual sources, each with associated dissolved phase contaminant distributions which have commingled into a single commingled distribution with steep or tight (i.e. large) concentration gradients; that is, the benzene concentrations fall off quickly with distance from the NAPL source. This observation is partially masked by the fact that there are very few places within the benzene plume where, as one moves downgradient from a given source, another source does not occur before end of the extent of contamination from the first source. Hence, at most points within the benzene plume, the benzene present is a result of a contribution from one or more NAPL sources. When observing the distribution as a whole, however, the concentration gradients are large (i.e. the concentrations taper off sharply with distance from the NAPL source) and the benzene plume appears to be stable. The primary reason for these observations is intrinsic biodegradation of benzene, although it also could be partially attributed to the small hydraulic gradient and groundwater flow velocity of these units.

EPA finds that it would not be practicable to restore water *between* the multiple NAPL sources at the former Del Amo plant, as they are so close together. In the course of attempting such restoration, contaminants likely would be pulled from surrounding sources. In addition, even if it were possible, such restoration of very small zones of clean water (on the order of a few hundred feet, at most, in size) in close proximity and in the midst of the multiple sources, essentially would provide no environmental benefit. Whether on the basis of contaminant mass, migration, or risk and concentration, the reduction of dissolved phase concentrations in these small areas would provide virtually no increase in the certainty of containing contaminants vertically or laterally, nor would the relative health risk be reduced in the event that the groundwater were used. It is noted that there would be no feasible use of groundwater from these localized "islands" of clean groundwater in the midst of the NAPL sources, because of their proximity to the NAPL sources. Finally, the long-term effectiveness and certainty of the groundwater remedy would be largely unaffected by such actions. For these reasons, EPA did not establish multiple small TI waiver zones within the benzene and TCE plumes in these units, but rather a single zone.

Basis for Establishing the TI Waiver Zone at the Boundary of the Existing Benzene Plume in These Units

In addition, based on the reasons discussed above and in Appendix E of the JGWFS, the ability of the available practicable remedial actions to decrease the extent of the dissolved benzene plume is at best highly limited. First, the size of the areas within the benzene plume that can be restored to MCL will be limited by the proximity of LNAPL sources and will not likely exceed several hundred feet. Second, the restoration of this limited area will never be complete due to the continuing dissolution of LNAPL into groundwater (See Appendix E of the JGWFS).

Accordingly, EPA has decided not to attempt to reduce the volume of, the benzene plume. *The TI waiver zone in the UBF and MBFB Sand is based on the area presently congruent with the existing benzene plume, as measured by the maximum contaminant level (MCL, the drinking water standard) for benzene (1 ppb).* The justification for this is discussed in detail in Appendix E of the JGWFS.

"Vertical Proximity" Basis for Extending the TI Waiver Zone into the MBFB Sand Under the Former Butadiene Plancor of the Del Amo Plant

Finally, there is an area of benzene contamination in the UBF (uppermost unit) in the former butadiene plancor of the Del Amo plant, near what is today called the "WRC building," and to the south of this building. Figure 7-2 shows this area as a scorpion-tail-shaped area on the easternmost portion of the UBF benzene distribution. In this location, there are two regions with direct observations of NAPL in the subsurface, and groundwater concentrations approach or equal the benzene solubility limit. EPA notes that wells were not installed in the MBFB Sand directly under this location. While wells with non-detect results located slightly downgradient provide a reasonable limit on the lateral extent of potential benzene contamination in both the MBFB Sand and the MBFC Sand, it has not conclusively been shown whether there is benzene in the MBFB Sand at this location. This ROD requires that this information be collected during the remedial design phase.

EPA has considered, if contamination does exist in the MBFB Sand directly under these NAPL sources, whether it would be practicable to restore the MBFB Sand at that location to ISGS levels. The MBFB Sand directly underlies the UBF with little to no separation to provide a significant barrier to the movement of contaminants. If the TI waiver does not extend to the MBFB Sand under this area of contamination in the UBF, it would be required that the benzene contamination in groundwater in the MBFC Sand be cleaned to ISGS levels. To achieve ISGS levels in this area, hydraulic extraction would be required directly under the benzene NAPL and the extremely high concentrations of dissolved benzene present in the UBF at this location. Such hydraulic extraction could increase vertical gradients between the UBF and MBFB Sand, which could cause the downward movement of dissolved benzene from the UBF to the directly underlying MBFB Sand. While gradient controls (such as limited counter-pumping in the UBF) could be applied, it would not be practicable to limit the contaminant movement from the UBF to the MBFB Sand to such a degree (virtually zero) that drinking water standards (1 ppb for benzene) could be achieved and maintained at this location in the MBFB Sand. The potential downward migration of high-concentration dissolved benzene caused by such pumping would more than offset benefits which might be derived from restoring water directly under the NAPL to ISGS levels. It is noted that there is no feasible use of groundwater directly under the NAPL in the UBF because of its proximity to the NAPL.

Therefore, while there may in fact be no contamination at all in the MBFB Sand at this location, it would not be practicable to restore this water to ISGS levels if contamination does exist. Based on this, EPA has extended the containment zone/TI waiver zone into the MBFB Sand directly under the LNAPL sources in the UBF. The extent of this portion of the TI waiver zone is based on the footprint of the contamination in the overlying UBF at this location. The TI waiver is extended to the MBFB Sand at this location due to its *vertical proximity* to the NAPL sources in the UBF. The argument for doing so is similar to the argument for extending the TI waiver zone laterally beyond the NAPL itself in any given unit due to *lateral proximity* to the NAPL.

EPA explicitly notes that the selected TI waiver zone for the benzene plume in the MBFB Sand is *not* based on the footprint of the benzene contamination in the overlying UBF at *all* locations in the MBFB Sand. This is only true in the area of the former butadiene plancor of the Del Amo plant. At other locations, the TI waiver zone in the benzene plume for the UBF and MBFB Sand are based on the present extent of benzene contamination in those units, respectively. This results in the TI waiver zone in the MBFB Sand being slightly smaller than in the UBF.

TCE Plume in the UBF and MBFB Sand

The TCE plume within the UBF and MBFB Sand is commingled with the benzene plume (see Figures 7-3 and 7-4). However, it does not extend as far downgradient as the benzene plume surrounding the waste pit area at the southern boundary of the former Del Amo plant property. The approach to the TCE plume is discussed further in Section 11 of this ROD.

Because the TCE plume in these units is *inside* the benzene plume, the TI waiver zone for the TCE plume in these units is the same as for the benzene plume, described above.

Benzene & TCE Plume in the MBFC Sand

The extent of the TI wavier zone in the MBFC Sand must be discussed in terms of both the benzene and TCE plumes at the same time. This is because the extent of the TI waiver zone in the MBFC Sand is not based on either the extent of the benzene plume or the TCE plume in that unit, but rather on the extent of the benzene plume in the MBF**B** Sand, the unit above. As discussed in Section 2 and Appendix E of the JGWFS, the presence of NAPL in the MBFC Sand, in either the benzene or TCE plumes, cannot be confirmed at this time with sufficient certainty upon which to base a TI waiver for the MBFC Sand.

Unlike the upper two units, the TCE and benzene plumes are not commingled in the MBFC Sand. The benzene plume in the MBFC Sand is limited to the area surrounding the Del Amo waste pits. There is no TCE at this location. The TCE plume is present to the north of the Del Amo Waste Pits, where the benzene plume is absent. Additional sampling will be conducted to determine the exact extent of the TCE plume, but its dimensions are bracketed by the existing sampling

locations. It is known that the extent of the TCE plume does not reach the Del Amo Waste Pits area, and its major source appears to be at or near several solvent-handling facilities just northwest of the MW-20 LNAPL area located at the northern end of the benzene distribution in the UBF/MBFB Sand.

"Vertical Proximity" Basis for Extending the TI Waiver Zone to the MBFC Sand

The benzene and TCE plumes in the MBFC Sand lie under and in vertical *proximity* to the LNAPL sources and the high-concentration dissolved benzene contamination in the UBF and MBFB Sand. Even though the presence of NAPL in the MBFC Sand in the benzene and TCE plumes has not been conclusively determined, EPA has extended the TI waiver zone to include the MBFC Sand in these plumes because of its location underneath the LNAPL sources. The rationale for this is as follows:

The MBFB and MBFC Sand are separated by a thin layer of mud, which exists only in the western portion of the Del Amo Site, and pinches out in the central portion (See Section 2 of the JGWFS). Without a TI waiver for the MBFC Sand, it would be required that the groundwater in the MBFC Sand be cleaned to ISGS for both TCE and benzene. To do so, hydraulic extraction would be required directly under the benzene NAPL and the extremely high concentrations of dissolved benzene present in the MBFB Sand. Such hydraulic extraction could induce vertical gradients, which in turn could cause the downward movement of dissolved benzene and TCE from the MBFB Sand to the MBFC Sand. The discontinuous layer of mud between these units will not likely serve as a sufficient barrier for such migration. While gradient controls (such as limited counter-pumping in the MBFB Sand) could be used to offset the increase in vertical gradients and limit the adverse downward movement of contaminants, it would not be practicable to limit the contaminant movement from the MBFB Sand to the MBFC Sand to such a degree (virtually zero) that drinking water standards (1 ppb for benzene) could be achieved and maintained in the MBFC Sand.

Basis for Establishing the Boundary of the TI Waiver Zone in the MBFC Sand as the Footprint of the Contamination in the Overlying MBFB Sand Benzene Plume

Based on the above discussion, the basis for extending the TI waiver zone to the MBFC Sand depends on vertical proximity of the contamination in the MBFC Sand to the LNAPL sources and high-concentration dissolved contamination in the MBF**B** Sand. Therefore, it is appropriate to define the boundary of the TI waiver zone in the MBFC Sand not in terms of the extent of the TCE and benzene plumes in the MBFC Sand but in terms of the footprint of the overlying MBFB Sand benzene LNAPL and high-concentration dissolved contamination (e.g. the projection of the lateral boundary of the benzene plume in the MBFB Sand onto the MBFC Sand). When the extent of the TI waiver zone in the MBFC Sand is defined in this way, it encompasses both the benzene and TCE plumes in the MBFC Sand. It is noted that the fine-grained LBF, which falls between the

MBFC Sand and the Gage Aquifer, would *not* be subject to a TI waiver outside the chlorobenzene plume.

10.5 Contaminants Moving Outside of TI Waiver Zone Become Subject to All ARARs

The TI waiver applies to the region of groundwater defined by Figure 10-1. The TI waiver does not apply outside the region. Contamination which may originate inside the TI waiver zone but over time come to be located outside the TI waiver zone are subject to all other applicable requirements of this ROD, including but not limited to the requirement that all ARARs be attained.

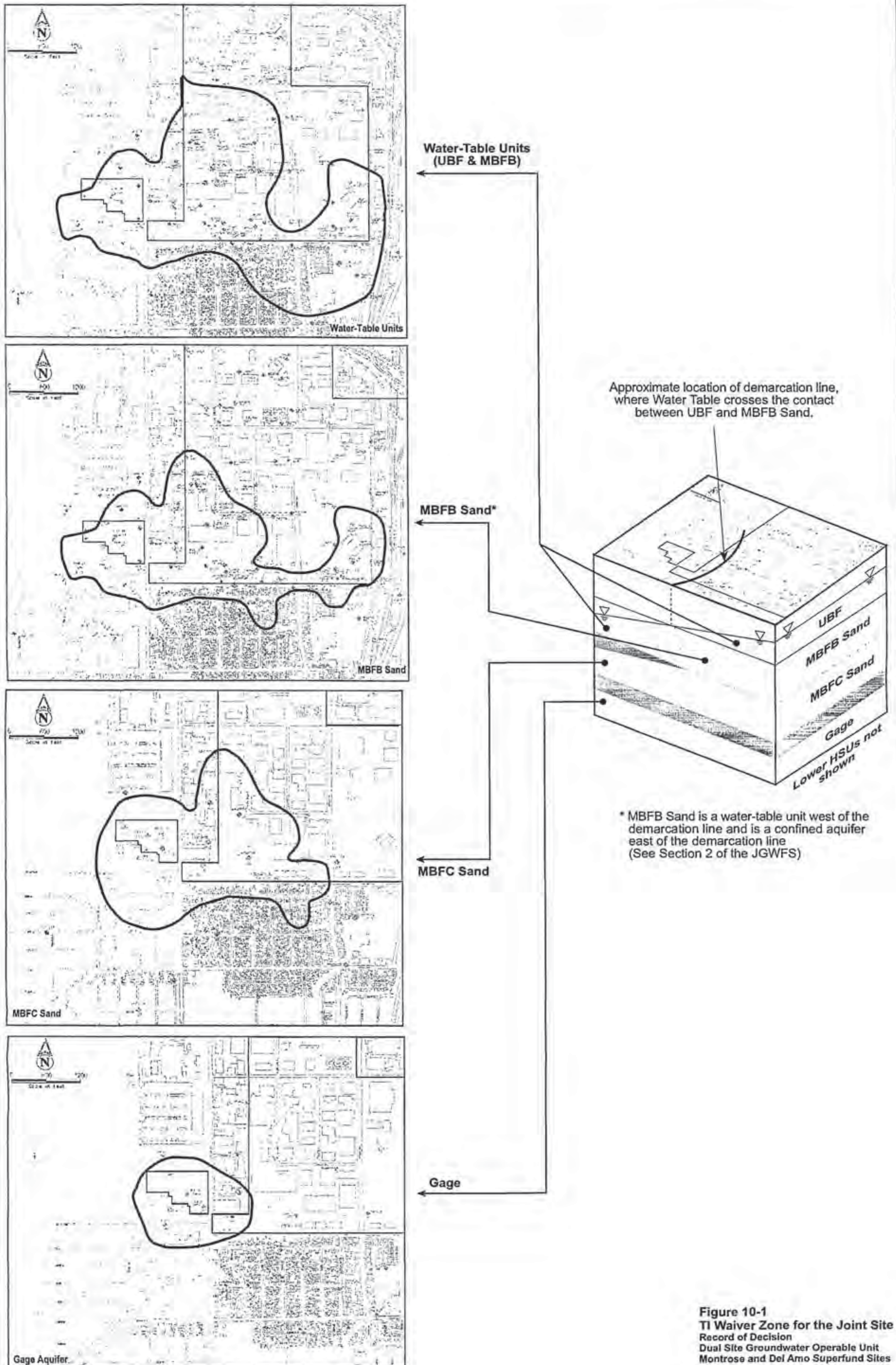


Figure 10-1
TI Waiver Zone for the Joint Site
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

11. Description and Characteristics of Alternatives

As part of the remedial action selection process leading to this ROD, EPA developed and evaluated five remedial alternatives. Each remedial alternative considered in the JGWFS, other than the No Action Alternative, contains: (1) a set of remedial actions for the chlorobenzene plume, (2) a set of remedial actions for the benzene plume, and (3) a set of remedial actions for the TCE plume. The JGWFS considered and evaluated potential interrelationships among the remedial actions for each plume in the process of assembling the alternatives. Alternatives and actions which would not be protective or would not attain applicable or relevant and appropriate requirements (ARARs) in a reasonable time frame were eliminated from further consideration prior to the detailed analysis of alternatives.

The JGWFS demonstrated that it is feasible to reduce and eliminate the volume of groundwater in the chlorobenzene plume outside the containment zone, while containing the contamination within the containment zone. The alternatives span three differing degrees of relative aggressiveness with respect to reducing the volume of the chlorobenzene plume outside the containment zone, in association with various combinations of means for containing the containment zone (recall that the chlorobenzene plume is the only plume with contamination *outside* the containment zone). This section describes the characteristics of these alternatives and Section 12 evaluates and compares them according to the nine NCP criteria.

Before the alternatives are described, several foundational aspects for the alternatives are documented. These evaluations provide a factual context for the alternatives that EPA considered in selecting this remedial action. Because this adds significant length to this section, the following outlines the section to assist the reader. Note that the actual description of elements within the alternatives does not begin until Section 11.3.

In Section 11.1, foundations and context for alternatives are discussed, including: (1) EPA's consideration of the potential for adverse contaminant migration, (2) critical aspects and limitations of the groundwater model that was used, (3) the potential and basis for reliance on intrinsic biodegradation as a remedial mechanism in alternatives, (4) situational aspects related to the TCE plume and why only one remedial option was appropriate for the TCE plume, (5) situational aspects related to the compound pCBSA, and (6) EPA's approach to alternatives. It is noted that alternatives and scenarios which EPA screened out in the JGWFS generally are *not* discussed in the ROD and the reader should consult the JGWFS for this information. Section 11.2 discusses factors related to measuring and addressing time frames for the remedial action, and the concepts of early time performance and pore volume flushing. Section 11.3 identifies the elements of the five alternatives which are common to all alternatives, other than the No-Action

alternative. Section 11.4 identifies the differentiating elements among the alternatives. Section 11.5 discusses treatment technologies and treated water discharge.

11.1 Foundation and Context for Alternatives

Consideration of Potential for Action Interrelationships and Adverse Migration

As discussed in Section 4, the various areas of groundwater contamination within the Joint Site are interrelated, and hence EPA has addressed it as a single operable unit. Factors evaluated in the development of remedial alternatives and the assessment of their feasibility during this remedial selection process included but were not limited to the potential for (1) remedial action interrelationships and (2) adverse migration of contaminants. The former refers to the movements of contaminants that might occur in other plumes in response to remedial actions that are designed and primarily targeted toward one plume. The latter refers to the undesired movement of contamination, including NAPL, in a manner that would violate the objectives of the remedial action. Before alternatives were ever constructed, the focus in defining, screening, and evaluating alternative prototypes in the JGWFS was to meet all remedial objectives for each plume while at the same time limiting or minimizing the potential for adverse migration of contaminants.

Migration of this type *could* include:

1. Movement of contaminants laterally or vertically in a manner which would make them more difficult to contain, or unacceptably increase the uncertainty associated with containing them within the containment zone;

2. Movement of contaminants in such a manner as would retard the attainment of remedial action standards set in this ROD (including but not limited to the attainment of drinking water standards for water outside the containment zone), or unacceptably increase the uncertainties associated with such attainment; or

3. Movement of contaminants that results in a spreading of the contamination to a larger area or to areas more likely to pose a risk from groundwater use.

Site-specific examples of potential remedial action interrelationships and adverse migration that EPA considered and accounted for in the remedial selection process include:

1. The potential for inducing NAPL to migrate downward or laterally in response to hydraulic extraction intended to contain the NAPL or reduce the plume outside the containment zone. Such movement, potentially caused by reducing interstitial pore

pressures or increasing vertical and lateral hydraulic gradients in the areas where NAPL occurs might: (1) threaten the ability of the remedial actions selected by this ROD to contain contaminants within the containment zone, (2) cause greater and more wide-spread migration of dissolved phase contamination associated with the NAPL, (3) lengthen and complicate the time necessary to achieve remedial objectives, and (4) potentially complicate the removal of NAPL by remedial actions being considered in the second phase of the groundwater remedy.

2. The potential for movement of the benzene plume downward or laterally in response to hydraulic extraction primarily focused on containing or reducing the chlorobenzene plume. This movement could result in the spreading of the benzene plume to areas of groundwater where it does not presently occur, including areas outside the containment zone and in the lower hydrostratigraphic units. In addition, more dissolved benzene could migrate into the chlorobenzene plume, in which biodegradation of benzene appears to be slower and less effective in reducing benzene mass.

3. The potential for movement of TCE downward or laterally in response to hydraulic extraction primarily targeting the chlorobenzene plume.

4. Potential for movement of contaminants from outside the Joint Site into the Joint Site in response to remedial actions being evaluated.

In the course of the remedy selection process, EPA has found that it is feasible to limit, control and even eliminate adverse migration of contaminants by a proper remedial design of the remedy. The JGWFS and the remedial selection process thoroughly evaluated the potential for adverse migration, considered the costs and benefits from the standpoint of the entire remedial action, and formulated remedial alternatives capable of controlling and limiting the impacts of such factors *while still meeting all other goals and objectives of the remedial action*, including but not limited to attaining ARARs in a reasonable time frame, and maintaining protectiveness of human health and the environment over the long term.

This does not mean that all the alternatives ultimately considered present the same risks with respect to adverse migration. In fact, some of the differences in such risks among the alternatives form a major basis for EPA's selection of one alternative over another. However, the alternatives have been constructed from the beginning of the JGWFS effort to take the potential for adverse migration into account, and the alternatives ultimately evaluated in detail by the JGWFS therefore encompass a reasonable range with respect to such potential. The appropriate alternative for selection therefore lies within that range.

EPA has not specified in this ROD that no adverse migration of contaminants shall occur at all, nor has it specified that the potential for such migration shall be completely eliminated. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL or dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. This ROD contains provisions for such a possibility, requiring that the remedial design be adjusted to reverse and contain the adverse migration. It is crucial to note that limiting adverse migration of contaminants shall not take preeminence over all other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

Therefore, for example, the remedial action shall be designed to reduce the chlorobenzene plume with the rate and efficiency required by this ROD. If, once the remedial action is implemented, adverse migration occurs at some location within the Joint Site, this ROD would require that additional wells or systems be implemented as required to minimize and contain that migration, as opposed to slowing the rate of cleanup by pumping less on the chlorobenzene plume. The former would represent adjusting to the migration within the context of continuing to meet ROD objectives. The latter would represent addressing migration at the expense of meeting ROD objectives.

Because potential remedial action interrelationships and adverse migration were considered intrinsically to the process of developing alternatives:

1. The remedial actions for each plume within each alternative are different than they would otherwise be if each plume had been considered independently and irrespective of the others. For instance, it is likely, though not certain, that EPA would have considered more aggressive cleanup rates for reducing the size of the chlorobenzene plume outside the containment zone, if the benzene plume did not exist. EPA did not do so because it had to keep the potential for adverse migration of the benzene plume, given potential influence from pumping on the chlorobenzene plume, within a reasonable range.

2. For each remedial alternative, the potential changes in drawdowns and gradients in the area of the DNAPL imposed by hydraulic extraction were evaluated, using the numerical model of the Joint Site groundwater discussed below. The locations and flow rates of wells in all considered alternatives were then adjusted to minimize the changes in gradients in the NAPL area. The results of modeling demonstrate the feasibility of limiting the inducement of NAPL migration under all remedial alternatives considered.

3. The JGWFS demonstrates that the goal of attaining ISGS levels in the aquifer outside the containment zone can be achieved without undue risks of adverse migration, if designed properly.

While it was appropriate for the JGWFS to evaluate the interrelationships among separate actions for each of three plumes, the remedial action as selected, designed, and implemented should not be considered a simple union of three disparate actions, but rather a unified whole addressing all requirements of the ROD. The various actions within the selected remedial action will be optimized together in the remedial design phase. To facilitate analysis, there is reference in the JGWFS and this ROD to separate wellfields [1] ("chlorobenzene wellfield," "benzene wellfield," etc.) but, in the final sense, the selected remedy will contain one optimized wellfield. Extraction and injection wells in the final design will generally serve a primary purpose with respect to one of the three plumes, yet may also have one or more purposes with respect to the other plumes, depending on the location of the wells. The description of alternatives in this section and the following section refer to actions for each plume separately to facilitate the documentation of the remedy selection process and to remain consistent with the feasibility study. But it should be remembered that remedial selection and design is not separable among the plumes.

The Joint Groundwater Model

A primary tool in the effort to evaluate (1) the performance of various remedial actions, (2) the potential for remedial action interrelationships, and (3) the potential for adverse migration of contaminants, was a computer-based groundwater flow and contaminant transport model. It is noted that the model was not the *only* tool used by EPA in these evaluations, and not all scenarios and types of movements were evaluated with the model (e.g., remedial actions focused on the TCE plume were not evaluated with the model). Also, the model (as with all models) has limitations which made it inappropriate for certain types of evaluations, as discussed in the JGWFS and briefly below. The model was used to the extent appropriate given its objectives, limitations, the data available, and the extent to which the model was necessary. An understanding of the modeling objectives and limitations is essential for the evaluation of alternatives and selection the remedial action in this ROD.

[1] Note: A "wellfield" refers to a particular configuration and number of hydraulic extraction and/or aquifer injection wells in physical space. Hydraulic extraction wells pull water toward themselves and create a cone of depression in the water table or in the head (pressure) distribution of the aquifer in which they operate. Injection wells push water away from themselves and create a "mounding" in the water table or an area of increased pressure in the head distribution of the aquifer in which they operate. In design, wellfields are generally varied until simulations of their operation produce the intended hydraulic effect on the aquifer system as a whole.

MODFLOW, a three-dimensional finite difference model, was used to simulate groundwater flow at the Joint Site. MODFLOW was linked to the transport model MT3D for the simulations of contaminant transport. The model domain was a rectangular area centered on, and extending beyond, the Joint Site, incorporating known and potential sources of contamination which lie in the vicinity of the Joint Site. The model grid consisted of 5,229 rectangular cells of 200- by 200-foot size in the primary area of interest, and 200- by 400-foot cells in the peripheral areas. Vertically, the model was divided into 13 layers of variable thickness to represent eight affected hydrostratigraphic units discussed in the JGWFS and in the previous sections of the ROD. Hydrogeologic properties were assigned to the model based on the results of remedial investigations performed at the Montrose and Del Amo Sites. In the peripheral portions of the model domain, hydraulic conductivities were interpolated based on a sequential gaussian protocol. The initial conditions for the contaminant plumes were assigned to the model based on contaminant distribution data collected during remedial investigations (See Section 2 of the JGWFS and the RI Reports; See Section 5 of this ROD). Fixed source term concentrations were used for areas of detected and suspected NAPL.

The model used for this analysis was a well-designed and highly useful tool for providing a basis for a comparative evaluation of remedial alternatives and an assessment of the approximate size and configuration of remedial systems required on a fairly large-scale. These are the purposes to which EPA has put the model in its analysis of alternatives for the Joint Site.

At the same time, the results of the groundwater model should only be seen in the context of, and as properly restricted by, the model's limitations. All models have uncertainties and limitations. EPA's intention in discussing them in this ROD is not to cast doubt on the quality or validity of the model or the modeling design effort used in this case. Rather, the intention is to establish that the model cannot be used for all purposes. Also, modeling results cannot be blindly trusted but must be accompanied by an assessment of the degree of certainty that can be attributed to them, given the nature of the input data and of the model itself. Some results provide greater certainty than others.

The modeling limitations applying to the model used for the JGWFS, and the reasons for them, are addressed in detail in Section 5 and Appendix B of the JGWFS. While the limitations do not diminish the valid uses of the model, they are critical to this remedy. Of particular note are the following:

- The model cannot be used to reliably simulate *absolute* cleanup time frames. Therefore, the evaluation of alternatives with respect to the cleanup time frame was focused on the relative rate of approaching complete cleanup (attaining remedial action objectives at all points in groundwater).

One of the reasons that the model cannot accurately estimate the total times to reach remedial objectives at all points in the Joint Site groundwater is that the model cannot account for sorption tailing effects, which mean that contaminant desorption from soils can occur at a slower rate than the rate at which sorption occurs (See Section 5 and Appendix B of the JGWFS). As a result, the simulated time frames from the modeling effort are likely to be shorter than the actual time required to complete the cleanup. While there are also other factors of which the model cannot account, such as potential unmeasurable intrinsic biodegradation, that may serve to lessen the actual cleanup times compared to simulated cleanup times, it is likely that the sorption tailing effects will dominate (See EPA's response to Montrose Chemical Corporation in the Response Summary to this ROD).

- The longer the time frame simulated, the greater the uncertainty associated with the modeling result. While the time to reach remedial objectives at all points in the Joint Site groundwater will likely be on the order of 100 years, simulations greater than the order of 50 years into the future are generally not reliable or useful. EPA has used simulations of 10-25 years for comparing remedial alternatives, even though the remedial action is not complete in that time frame under any of the alternatives. This provides a measure of each alternative's *relative* performance and progress at 25 years toward meeting the remedial objectives.

- The model cannot account for or simulate local small-scale heterogeneities and preferential flow paths, which could provide an explanation for some of the observed contaminant distributions. This is primarily for two reasons:

    1) The model has a limited resolution (cell size 200 by 200 feet), hence, the model cannot accurately estimate movements of water and contaminants along the potential preferential flow paths that are smaller than the size of one cell.

    2) Local heterogeneities and preferential flow paths may be only a few feet or tens of feet in size, yet still be able to affect contaminant fate, transport, and distribution. The data from the remedial investigations are not sufficient to define heterogeneities of such a size, nor would it be practicable to obtain such data in most cases.

- The modeling results for vertical transport from the MBFC Sand through the LBF to the Gage Aquifer, and for vertical transport from the Gage Aquifer through the Gage-Lynwood Aquitard to the Lynwood Aquifer, are associated with such high uncertainty as to be largely unreliable (See Section 5 and Appendix B of the JGWFS). EPA did not use the model for these purposes.

- The model cannot be used to simulate movement of the chlorobenzene plume in the MBFB Sand (water table units) near the former Montrose plant because of the high level of uncertainty associated with the hydrogeologic parameters of the MBFB Sand in this area (See Sections 2 and 5 of the JGWFS).

Key Findings of the Joint Groundwater FS

The model was not used as the exclusive determiner but rather as one tool in reaching these findings. The model was not used in reaching all of these findings. Among the key findings of the JGWFS are the following:

- Hydraulic containment (isolation) of the NAPL at the Joint Site feasibly can be achieved. The size of the containment zone must be somewhat larger than the actual physical dimensions of the DNAPL source to avoid the adverse impacts of hydraulic extraction on the migration of NAPL. The associated pump rates have been approximated with assistance from the model.

- Adverse downward migration of chlorobenzene DNAPL can be avoided by strategic placing of hydraulic extraction wells (pumping wells) in such a manner that hydraulic impact from these wells in the DNAPL zone is minimal (if any)

- Injection of treated water is considered a *necessary* component of the alternatives for the chlorobenzene plume, because it minimizes potential adverse migration of NAPL and the benzene and TCE plumes, minimizes the hydraulic impact on sources of contamination at the periphery of the Joint Site, and assists in preventing dewatering of the aquifers during extraction and treatment.

- Reducing the volume of the chlorobenzene outside the containment zone (i.e. restoration of the chlorobenzene plume) is feasible. Three different wellfields were examined which fall on a scale of increasing relative aggressiveness: a 350 gallon-per-minute (gpm) wellfield, a 700-gpm wellfield, and a 1400-gpm wellfield. The long and short-term performance of these wellfields has been evaluated and is described in the JGWFS, and is discussed and summarized in this ROD in Sections 11 and 12.

- It is feasible to minimize or eliminate adverse movements of the benzene plume and TCE plume were hydraulic extraction in the chlorobenzene plume to occur at any of the three degrees of relative aggressiveness (in terms of pumping rates) considered. Optimization of the wellfields would be necessary in remedial design, however.

- Hydraulic influences on contaminant sources outside the Montrose and Del Amo Sites and plumes, such as the Mobil Refinery to the west and the McDonnell Douglas facility to the north of the former Montrose plant, can be mitigated if treated water is injected in the aquifer (aquifer injection) as part of the remedial action.

- If no action is taken for the chlorobenzene plume, it will likely continue to migrate, as determined by the evaluation of the fate and transport of chlorobenzene including numerical modeling (See Montrose RI Report and Section 5 of the JGWFS).

- If no action is taken for the TCE plume, it will likely continue to migrate, as determined by the evaluation of fate and transport of TCE including numerical modeling (See Del Amo Groundwater RI Report and Section 5 of the JGWFS). The modeling results for the TCE plume are less certain than for the chlorobenzene plume.

- Little reduction in the volume of the benzene plume can be attained by pumping it, because of the presence of multiple LNAPL sources that cannot be isolated from the rest of the benzene plume. (See Appendix E of the JGWFS and Section 10 of this ROD). In addition, hydraulic containment of the benzene plume in the UBF and MBFB Sand provides little-to-no benefit compared to reliance on intrinsic biodegradation only (See Section 5 of the JGWFS). The benzene plume in the MBFC Sand feasibly can be contained by pumping, however, and there are reasonable benefits to be considered from such pumping. This is further discussed in Section 12 of this ROD and in Section 5 of the JGWFS.

Potential for Reliance on Monitored Intrinsic Biodegradation

Section 7.3 of this ROD briefly addressed the presence of intrinsic biodegradation of contaminants as a matter of site characteristics. As discussed there, intrinsic biodegradation is a form of natural attenuation which occurs when innate microorganisms metabolize site contaminants (See Section 7.3 and the JGWFS).

This section evaluates intrinsic biodegradation at the Joint Site from the standpoint of the potential to *rely* on it as a mechanism to meet remedial objectives. Intrinsic biodegradation can slow, halt, or reverse the outward migration of a dissolved phase contaminant in groundwater. Hence, EPA evaluated the potential for utilizing it as a means of containing all or portions of the containment zone. However, intrinsic biodegradation only occurs under certain conditions, and with certain contaminants. To rely on intrinsic biodegradation in a remedial context, it must not only be present but there must be enough confidence that it will reliably achieve the remedial objective for which it would be used. It is possible to have confidence in the presence of intrinsic biodegradation, but low certainty with respect to its ability to meet remedial objectives.

For the Joint Site, intrinsic biodegradation was considered potentially reliable for *containment* of the benzene plume, and is incorporated in the remedial alternatives as a containment mechanism to varying degrees for the benzene plume. However, intrinsic biodegradation was not considered potentially reliable for containment of the chlorobenzene and TCE plumes, and was not incorporated into alternatives for these plumes. Intrinsic biodegradation also was not considered potentially reliable for reducing the volume of contamination outside the containment zone, and was not incorporated into alternatives for this purpose. The basis for this is described further below.

Potential for Reliance on Intrinsic Biodegradation in the Benzene Plume

Recalling Sections 9 and 10, the remedial objectives for the benzene plume include only containment; there is no portion of the benzene plume, which lies *outside* the containment zone/TI waiver zone.

At the Joint Site, there is significant evidence of *reliable* intrinsic biodegradation of the benzene plume in the UBF and the MBFB Sand. The factors present with respect to the benzene plume that support the ability to rely on intrinsic biodegradation as a remedial mechanism for this portion of the benzene plume include several of those listed in Section 7.3:

- The concentration gradients at the leading edge of the benzene plume are steep;
- The lateral extent of the dissolved plume outside of the NAPL sources is small;
- The benzene plume is much smaller than what would be expected based on groundwater velocity and expected retardation in the absence of intrinsic biodegradation; benzene has not migrated far from the NAPL sources despite likely being in the ground 20-40 years;
- The plume appears to be stable and does not appear to be migrating laterally;
- In-situ measurements of geochemical parameters (e.g. dissolved oxygen, nitrate, sulfate, methane, etc.) indicate biological activity that is related to (varies spatially with) the benzene concentration in groundwater;
- Biodegrader organism counts in groundwater indicate greater biological activity inside the benzene plume than outside the benzene plume;
- Computer modeling runs could not be reasonably calibrated without assuming significant benzene biodegradation;

- An extensive body of research and literature is available to support that: a) the chemical pathways by which benzene degrades are well understood, b) benzene is known to biodegrade in a wide range of conditions in the laboratory, and c) benzene is known to biodegrade in a wide range of environmental conditions in the field, including those found at the Joint Site.

It is noted that any *one* of these factors, taken by itself, does not conclusively prove that intrinsic biodegradation of benzene is occurring in the benzene plume groundwater nor that it occurs reliably. However, when all lines of evidence are taken together, the case for reliable intrinsic biodegradation of benzene *in the benzene plume* is strong. These multiple factors not only indicate that biodegradation is occurring, but that it is occurring to an extent that the benzene plume in these units is being naturally contained by the intrinsic biodegradation process. Moreover, the extent of this naturally-contained plume essentially coincides with the TI waiver zone defined in Appendix E of the JGWFS and Section 10 of this ROD. It is therefore reasonable to conclude that intrinsic biodegradation can serve as a mechanism to meet the objectives for benzene plume containment for the UBF and MBFB Sand.

Reliance solely on monitored intrinsic biodegradation as a remedial mechanism for the benzene plume in the UBF and MBFB Sand is additionally appropriate for the following reasons:

- The UBF and the MBFB Sand have low permeability, which is 10 to 100 times less than the permeability of the MBFC Sand and the Gage and Lynwood Aquifers. Therefore, groundwater flow velocities, and consequently, rates of contaminant migration, are low in these units even in the absence of intrinsic biodegradation.

- These units are shallow and separated by several thick hydrostratigraphic units, including aquitards, from the units most likely to be used for drinking (although the State classifies all water under the site as having potential beneficial potable use). The result is that the risk associated with a failure of intrinsic biodegradation to contain the benzene plume in these two units would be low, provided containment is properly monitored.

Similar lines of evidence exist to support the presence of intrinsic biodegradation in the benzene plume in the MBFC Sand. Based on sampling conducted to date, it appears that the limited extent of the benzene plume in the MBFC Sand could be attributed to intrinsic biodegradation, which acts to contain the benzene in the UBF and MBFB Sand under the existing condition of the natural system. However, there is more uncertainty as to whether intrinsic biodegradation would be reliable to contain the benzene plume in the MBFC Sand, given the high permeability of the MBFC Sand, which could potentially result in higher contaminant migration velocities when hydraulic extraction is undertaken with the primary focus of reducing the chlorobenzene plume.

In addition, the MBFC Sand is separated from the Gage Aquifer only by one layer, the LBF, which creates a higher risk with respect to contaminating deeper aquifers, including those more likely to be used for drinking, should intrinsic biodegradation fail to contain the contamination, making reliance on it more dubious. This is thoroughly discussed in Section 5 of the JGWFS and Section 12 of this ROD. EPA included one alternative in which intrinsic biodegradation is relied upon for containing the MBFC Sand, and several other alternatives where it is not relied upon. The evaluation and comparison of alternatives in Section 12 discusses the benefits and drawbacks of each.

Potential for Reliance on Intrinsic Biodegradation for the Chlorobenzene Plume

Recalling Sections 9 and 10, the remedial objectives for the chlorobenzene plume include containment within the containment/TI waiver zone, and reduction of large volume of the plume outside the containment/TI waiver zone. EPA has determined that intrinsic biodegradation of chlorobenzene is not a *reliable* mechanism to attain either objective. The basis for this determination, and its relation to the determination made for the benzene plume, is advanced in the following discussion.

The lines of evidence just discussed for the benzene plume do *not* apply to the benzene that is commingled with the chlorobenzene plume (this benzene is, by definition, *in* the chlorobenzene plume). This benzene has migrated up to three-quarters of a mile in the MBFC Sand from the former Montrose Chemical and Del Amo plants with no known intervening sources. EPA has considered two possible explanations for the observation that the benzene commingled with chlorobenzene appears to have moved a significant distance from the benzene sources, in contrast to the benzene that is not commingled with chlorobenzene. The first, and most probable, explanation is that the presence of chlorinated organic contaminants, such as chlorobenzene, retards the rate of biodegradation of benzene, allowing it to migrate further in groundwater before it degrades. The second possible explanation is that chlorobenzene itself is degrading to benzene within the chlorobenzene plume. EPA believes it is not likely that this is occurring sufficiently to create the observed concentrations of benzene in the chlorobenzene plume; moreover, chlorobenzene degradation, if it occurs, is not sufficiently understood in the field to confirm reliably that benzene would be a byproduct. Further discussion ensues.

In contrast to the benzene plume, sufficient lines of support for the presence of reliable intrinsic biodegradation of *chlorobenzene* at the Joint Site are not present. While intrinsic biodegradation of chlorobenzene may be occurring to some degree,

- The state of the chlorobenzene plume, especially the fact that the plume has been able to expand to its large lateral and vertical size, is not supportive of the presence of significant and dependable intrinsic biodegradation of chlorobenzene and indicates that such

degradation is not likely to be substantial enough to rely upon as a remedial mechanism in remedy selection;

- The mechanisms by which chlorobenzene can be degraded in groundwater at the Joint Site, while outlined in theory, are only partially understood, are supported by a relative sparsity of laboratory studies, and are even less-well understood under field conditions, particularly in the conditions likely to exist at the Joint Site;

- Of the relatively few laboratory studies pertaining to biodegradation of chlorobenzene, those in which biodegradation occurred were performed under aerobic (oxygen present) conditions; other studies showed that biodegradation of chlorobenzene may be inhibited under anaerobic (oxygen absent) conditions; yet the conditions in the aquifers in which chlorobenzene contamination is extensive (in particular, the MBFC Sand and the Gage Aquifer) are likely to be anaerobic, not aerobic (for more information, see JGWFS).

The following two factors, in conjunction with the above observations, further imply that intrinsic biodegradation of chlorobenzene cannot be conclusively relied upon in a remedial context:

- The chlorobenzene is located in deeper aquifers with higher transmissivities. There is therefore greater potential for it to move more rapidly laterally and vertically, and it is closer to the aquifers most-likely to be readily used for drinking (it is noted that the State of California classifies all groundwater at the Joint Site as potential drinking water; the distinction made here is therefore one of the degree of likelihood of groundwater use, rather than of the classification of the aquifer). Moreover, because it becomes more difficult and expensive to characterize deeper aquifers fully, the deeper the contamination the more uncertainty associated with its long-term movement. These factors imply a greater risk associated with reliance on intrinsic biodegradation for the chlorobenzene plume, because the implications in the event that intrinsic biodegradation should fail are much more serious than for the shallower hydrostratigraphic units.

- It is unlikely that the biodegradation rate for chlorobenzene could be measured in the field with enough certainty that would allow for it to be used as a reliable remedial mechanism. The reasons for this were presented in detail in the JGWFS and in a letter from EPA to Montrose Chemical dated September 10, 1997. These reasons are also discussed in the Response Summary in this ROD, Response to Montrose Chemical Corporation, EPA Response ✍ 29.

Appendix B of this ROD provides explanations pertinent to the approach to characterization of intrinsic biodegradation for the benzene and chlorobenzene plumes.

Potential for Reliance on Intrinsic Biodegradation in the TCE Plume

The TCE plume, as defined in Section 7.2 of this ROD, is presently within the containment zone as defined in Section 10 of this ROD. There is no evidence to conclude that the TCE plume is subject to intrinsic biodegradation sufficient to keep it contained or to reduce its volume. As discussed in Section 7.3 of this ROD, (1) the range of rates of intrinsic biodegradation of TCE (and PCE) measured at other sites is much less (as much as 100 times slower) than the corresponding range for benzene, (2) limited modeling performed on TCE in the JGWFS, which assumed that TCE degrades at rates similar to those found at other sites, indicated significant migration of TCE would occur over time, particularly if hydraulic extraction is undertaken for the chlorobenzene plume, and (3) data from the remedial investigation indicate that TCE and PCE are migrating under existing conditions (that is, the TCE plume is not presently spatially stable with time). As with the chlorobenzene plume, intrinsic biodegradation may be occurring to some degree in the TCE plume. The significant rate of biodegradation of benzene in the benzene plume may be enhancing the rate of biodegradation of TCE in a process called co-degradation. This may, in fact, result in significant reductions in the field resident half-life of TCE at the Joint Site (and hence, the rate of its movement over time) compared to typical half-lives for TCE in the absence of benzene degradation. However, such processes cannot be *relied* upon with significant or sufficient certainty to the extent that they could be used as remedial mechanisms to contain or cleanup the TCE plume.

Basis for Using One Option for the TCE Plume in All Alternatives

All remedial alternatives that EPA considered in the remedial action selection process, other than Alternative 1, No Action, contained the same action for the TCE plume[2]. The rationale for including the same remedial action for TCE within the alternatives is presented below. The TCE action itself is discussed in Section 11.2. In general, there is both a need for a remedial action to contain the TCE plume, as well as significant limitations on the manner in which such an action can reasonably be implemented, due to the TCE plume's commingling and/or proximity to the benzene plume and benzene NAPL..

[2]The reader is reminded that in this ROD, unless otherwise noted, the term TCE refers to the family of chlorinated solvents including trichloroethylene (TCE), perchloroethylene (PCE), trichloroethane (TCA), and dichloroethylene (DCE). The term "TCE plume" refers only to the TCE that is *not* commingled with chlorobenzene presently. The TCE plume lies, primarily, under the former Del Amo plant. See Section 7, "Summary of Site Characteristics," for discussion on the distribution of TCE.

Why a TCE Action Can Be Selected Despite Data Limitations

As mentioned earlier, the amount of data available regarding the TCE plume is comparatively less than that for the benzene and chlorobenzene plumes. The extent of the TCE plume at the Joint Site is bracketed spatially in the downgradient direction, and there is evidence as to the presence of sources of TCE contamination along the western border of the former Del Amo plant. The former Del Amo plant as well could have been a source of TCE. Because of the lesser amount of characterization data, TCE remedial scenarios were not directly modeled, and the TCE plume was addressed on a conceptual, performance-based level. In order to complete remedial design, additional confirmatory data on the TCE plume, including its exact extent in each of the hydrostratigraphic units as well as information about sources of TCE, is necessary.

EPA did not collect this data during the RI phase in part because the need for it was not apparent until late in the RI process, but *primarily* because the necessary approach to the TCE plume, from a remedy selection standpoint, is evident and supportable from the existing data, in large part due to the TCE plume's proximity to the benzene plume. The specific situation in which the TCE plume occurs means that less information is needed about it to *select* a remedy for it. This would not be the case if the benzene plume and benzene NAPL were not also present. This is described in more detail below. EPA acknowledges, however, that additional data about the TCE plume will be necessary to complete the remedial design phase, and this ROD requires that such data be collected (See Section 13, "Specification of the Remedial Action"). EPA also has the authority to amend the ROD if necessary to address conditions revealed during this sampling.

Why a Remedial Action for the TCE Plume is Necessary

As discussed in the section above regarding reliance on biodegradation, the data and information available suggest that the TCE plume is likely to move adversely in response to changes in hydraulic conditions, such as would occur from pumping in the chlorobenzene plume. In fact, data suggest that the TCE plume is migrating under current conditions, even before such pumping takes place. Laboratory and field studies indicate that under most conditions TCE biodegrades at significantly lower rates in the field than does benzene, which is proven to be highly and robustly biodegradable. The TCE plume appears to have moved farther from the apparent sources compared to benzene, despite the fact that the TCE sources may be younger than the Del Amo benzene sources. This is owing to the fact that the presence of the TCE in part may be due to sources which have come into operation since the close of the former Del Amo plant.

Based on this higher potential to move in response to adding outside hydraulic influences to aquifers nearby the TCE, containment of the TCE will be necessary to prevent adverse movement of the TCE. Moreover, intrinsic biodegradation cannot be relied upon to obtain this containment (see previous section). Intrinsic biodegradation of TCE, to the extent it occurs, will enhance the

action selected by EPA for TCE and by assisting in keeping the TCE contained. However, active hydraulic containment, using hydraulic extraction with aquifer injection of treated water, will be necessary to keep the TCE contained.

Why Appropriate Versions of Active Hydraulic Containment for the TCE Plume are Limited

While it is necessary that hydraulic extraction be applied to the TCE plume, the manner in which it feasibly can be implemented is limited by its proximity to the high-concentration dissolved phase benzene and benzene NAPL. On this point, the following discussion addresses the MBFB Sand and MBFC Sand in turn.

In the MBFB Sand, the TCE plume is commingled with the dissolved phase benzene plume at high concentrations and the benzene NAPL in the benzene plume. Accordingly, using hydraulic extraction to remove the TCE from within the benzene plume would not a reasonable option, as it would require pumping the benzene plume in the fine grained upper units. This is a prospect which does not further the objective and requirement of containment, and, consequently, was screened from further consideration.

In the MBFC Sand, the TCE plume lies directly *under* the high-concentration dissolved phase benzene plume and NAPL in the MBFB Sand. Thus, either containing or reducing the concentrations of TCE in the MBFC Sand would require hydraulic extraction under the MBFB Sand contamination at the former Del Amo plant. Because of the thin stratigraphic separation between the MBFB Sand and the MBFC Sand, this would move some contamination downward from the MBFB Sand to the MBFC Sand. Such hydraulic extraction would impose significant risks and implementation problems because of the benzene NAPL lying directly above the MBFC Sand being pumped.

Based on existing data, EPA does not believe that hydraulic extraction directly under the benzene plume in the MBFB Sand is appropriate. If data collected in the remedial design phase indicates pumping of the MBFC Sand is necessary under the benzene plume and benzene plume NAPL in the MBFB Sand, EPA could modify the proposed remedy to include such a component to the remedial action. Instead, EPA's selected action for the TCE plume ensures that it remain contained within the containment zone, but does not require that pumping take place directly under the high concentrations of benzene in the MBFB Sand. This is consistent with other remedial action components in this ROD where the containment zone is affected by hydraulic pumping. In such cases, the extraction well or wells used to achieve the containment purposely have been located downgradient of the NAPL, rather than directly in the midst of or under the NAPL, so as to avoid inducing the movement of the NAPL (and associated high dissolved concentrations of contaminant) downward.

In summation, if remedial objectives were to be attained, EPA did not have multiple options as to whether the TCE plume would be contained, nor as to whether or how hydraulic extraction would be used. EPA has selected the option for the TCE plume presented in Section 11.3. This option was included as a component in all alternatives considered, other than the No-Action alternative. This alternative is largely performance-based, and insures that: (1) the immediate TCE sources are partially contained by localized pumping in the MBFB and MBFC Sand, and that (2) the TCE plume remains contained within the containment/TI waiver zone. The TCE action is described in Section 11.3.

11.2 Characterizing Time Frames and Efficiencies

As discussed, the two most fundamental elements of this remedial action are: (1) containing the containment zone, and (2) eliminating the dissolved phase groundwater contamination outside the containment zone with concentrations above ISGS levels. The containment zone must be contained indefinitely, and this containment is accomplished by a combination of hydraulic extraction and treatment (with assistance from aquifer injection of treated water), and reliance on intrinsic biodegradation. Eliminating the dissolved phase contamination outside the containment zone is accomplished in every alternative by hydraulic extraction and treatment of groundwater. The concepts in this subsection place the performance characteristics of the alternatives into context.

Long Time Frames and How Time To Achieve Objectives Is Characterized

The duration of the remedial action selected by this ROD is long in two three respects:

- The presence and manner of occurrence of NAPL at the Joint Site requires that the containment zone remain contained *indefinitely*.
- The attainment of ISGS levels at all points in the chlorobenzene plume outside the containment zone (the part of the plume subject to plume reduction) will take a long time due to:
  - The large size of the plume and the number of hydrostratigraphic units affected;
  - The complexity (heterogeneity) of the subsurface, including relatively low-permeable zones, where achievable extraction rates of wells, and consequently the flushing rates, will be low.

These introduce complexities in terms of characterizing and evaluating the time to reach objectives.

It is important to note that cleanup of the contamination *inside* the containment zone is *not* a remedial objective of this action. It is true that over an extremely long time, all of the NAPL will eventually dissolve into the groundwater in the containment zone. However, this will not occur in a reasonable time frame. The process of NAPL dissolution is too complex and its completion too far removed in time to obtain any reasonable estimate of the time interval, other than to say that it may be on the order of centuries. This ROD does *not* consider NAPL dissolution to be a remedial mechanism, and the action for the containment zone is characterized as "indefinite containment," not "cleanup by dissolution." As such, the alternatives are not characterized in terms of the time for NAPL dissolution to be complete.

In contrast, eliminating the contamination above ISGS levels *outside* the containment zone *is* a remedial objective for this action, and hence the time required to accomplish this objective, and the relative rate and efficiency with which this occurs, are pertinent and appropriate characteristics within which to frame alternatives. Because the benzene and TCE plumes lie entirely within the containment zone to begin with, this objective applies solely to the chlorobenzene plume outside the containment zone.

As discussed in Section 11.1, the time frame to reach ISGS levels at all points in the groundwater outside the containment zone was evaluated in terms of the progress in approaching this objective, rather than by obtaining a total time frame directly from the model. This is because modeling simulations of cleanup time frames can only be used on a relative, not absolute, basis, and because the total time to clean up is longer than the time the model can reliably simulate.

Instead of characterizing and comparing alternatives based on the simulated total time to reach objectives, EPA compared their simulated relative performance within a 25-year time frame. The uncertainties associated with 25-year simulations are lower and the model's results are more reliable. The total time to reach the objective of eliminating the chlorobenzene plume outside the containment zone is inferred on a relative basis from each alternative's performance at 25 years. This provides a reasonable basis for comparison among alternatives in terms of total cleanup time, even though a certain value for the total cleanup time is not available.

As will be discussed in Section 11.3, the four alternatives other than No Action differ in terms of the relative aggressiveness with which the chlorobenzene plume outside the containment zone is reduced. However, the time needed for the volume of the chlorobenzene plume outside the TI waiver zone to shrink to zero is long (in excess of 50 years) even in the fastest alternative considered. This consideration, and the consideration that the containment zone must remain effective indefinitely, form a primary context for the characteristics, comparison and selection of alternatives which takes place in this Section and Section 12 of this ROD.

Early Time Performance

When using hydraulic extraction, aquifer injection and treatment to reduce the size of a plume, plume reduction often does not occur at a constant rate. It is the last fraction of plume reduction of the chlorobenzene plume, closest to the containment zone, which may be the most difficult and take the longest to remove. Some of the alternatives considered are able to remove a large majority of the plume very quickly, leaving only a small percentage of the plume to be addressed over the relatively long remainder of the remedial action. Other alternatives remove very little of the plume until very late in the total cleanup time. As just discussed, the time frame required to reach remedial objectives at all points in the chlorobenzene plume outside the containment zone is extended so it becomes appropriate to consider to what *degree* the remedial objectives are achieved in the interim period during the remedial action but prior to actually attaining remedial objectives. In this ROD, EPA refers to this concept as ***early time performance.***

Pore Volume Flushing

For the groundwater contamination which lies outside the containment zone, this remedial action relies on hydraulic extraction and aquifer injection, as discussed above. These actions induce hydraulic (pressure) gradients in the ground which force water to move. ***Flushing*** is the process by which dissolved contaminants are mobilized and removed by the water movement induced by hydraulic extraction and/or aquifer injection. In this process, contaminants adsorbed to soils in the saturated zone are induced to desorb (this occurs at a limited rate) into the dissolved phase. In short, flushing is the means by which hydraulic extraction and aquifer injection accomplish the "cleaning" of the aquifer. ***Pore volume flushing*** is a measure of the number of times the volume of water in the interstitial pores in the soil will be exchanged per unit time through a hydraulic extraction/aquifer injection system.

Two factors of importance with respect to pore volume flushing are its magnitude and its distribution. Pore volume flushing is typically optimized during remedial design of the wellfield. However, this remedy selection process examined the issue of general overall pumping rate ("aggressiveness") in reducing the chlorobenzene plume, in light of potential adverse migration and plume interactions. Therefore, an evaluation is appropriate on a general level as to whether each alternative will (1) produce significant pore volume flushing and (2) whether given an approximate overall pump rate, pore volume flushing can be reasonably distributed to cover the entire portion of the chlorobenzene plume outside the containment zone. EPA has therefore characterized the alternatives in terms of pore volume flushing prior to making the formal comparison of alternatives.

Pore volume flushing rate magnitudes and distributions, simulated for each of the remedial alternatives, can be found in Appendix B of the JGWFS.

11.3 Elements Common to All Alternatives

Containment Zone and Restoration Outside the Containment Zone

As discussed in Sections 4 and 10 of this ROD, all alternatives considered by EPA in this remedial selection process (other than the No Action Alternative, Alternative 1) follow the approach of hydraulically containing a zone of groundwater around the NAPL, thereby isolating it from the remainder of the groundwater, which can then be cleaned. In keeping with this approach, all alternatives considered for this remedy other than No Action include a Technical Impracticability (TI) waiver for certain ARARs, to be applied to a zone of groundwater (shown in Figure 10-1), in which contaminants in groundwater are indefinitely contained. This was thoroughly discussed earlier in Section 10 of this ROD. The TI waiver zone and containment zone refer to the same physical space.

Contingent Actions

All of the alternatives except for No Action utilize hydraulic extraction and treatment as the means by which a substantial portion of the containment zone is contained. All alternatives except for No Action also rely upon monitored intrinsic biodegradation as the means by which the balance of the containment zone is contained. The basis for this reliance is discussed in a later subsection of this section. The degree to which monitored intrinsic biodegradation is relied upon varies in some of the alternatives, as discussed below. In general, under all alternatives other than No Action, all of the containment zone within the chlorobenzene plume is contained by hydraulic extraction, and some or all of the benzene plume is contained by reliance on monitored intrinsic biodegradation, depending on the alternative.

Because it is a passive and pre-existing natural condition, the efficacy of intrinsic biodegradation must be consistently monitored when it is applied. Moreover, it is not only appropriate but necessary that contingent and active measures be available should monitoring indicate that the remedial objective of containment is not being met by the passive process. Where it is applied by this ROD, monitored intrinsic biodegradation is relied upon solely to the extent that it successfully contains dissolved phase contamination within the containment zone. Should it fail to do so, hydraulic extraction and treatment shall be implemented as a contingent action, replacing monitored intrinsic biodegradation as the means of containment in such areas.

It is not possible at the time of issuing the ROD to specify exactly all aspects of the contingent action that would be taken if reliance on intrinsic biodegradation fails to contain the benzene plume where it is applied. This would be impractical because the number of possible types of failure is very large. The nature of any given containment transgression, including its vertical and lateral location, extent, and contributing causes, cannot be foreseen in advance but would largely

determine the detailed aspects of the contingent remedial action appropriate to correcting the transgression (e.g. where to apply extraction, injection, how to modify local pump rates, etc.) These aspects are largely a matter of design adjustments during the operation and maintenance phase of the remedial action. This ROD therefore specifies, on a performance basis, that contingent actions will be determined and undertaken in order to restore the condition of containment and that such actions will utilize active hydraulic extraction and treatment. Aquifer injection has the capability to alter aquifer hydraulics and assist in effecting or restoring containment. Where it is appropriate, and can be utilized in accordance with ARARs, aquifer injection can be used to supplement hydraulic extraction and treatment for such purposes.

Provisions for contingent actions are more fully detailed in Section 13.

Monitoring

All of the alternatives, except the No Action Alternative, include long-term and continual monitoring to confirm containment, remedial action performance, and other factors mentioned more specifically below and in Section 13. All of the alternatives also require periodic well surveys, both of private and public wells, to ensure that groundwater is not being used in a manner that would present an unacceptable health risk within the area of groundwater contamination that remains as the remedial action progresses.

Additional Data Acquisition

All of the alternatives, except the No Action alternative, would require that additional data be collected at the Joint Site, including but limited to:

- Data sufficient to further identify TCE sources within the Joint Site and to characterize the exact extent of its distribution;
- Data to further characterize the benzene plume in the MBFB Sand under the butadiene plancor of the former Del Amo plant; and
- Data to further characterize the downgradient extent of the pCBSA plume.

Institutional Controls

All alternatives other than No Action would include certain institutional controls.

Existing legal and regulatory requirements exist that may limit the use of groundwater in the contaminated area at the Joint Site. However, EPA is not in control of these requirements, in that EPA cannot ensure that (1) these authorities will remain "on the books" for the duration of this remedial action, and that (2) these requirements will be enforced in accordance with the requirements of this ROD. Among these requirements are the adjudication of the Los Angeles Groundwater Basin, as described in Section 7, as well as limitations and requirements on well installations imposed by the State Water Resources Control Board. As discussed in Section 7, these controls cannot be relied upon by EPA to be effective in the long term other than as an enhancement to the proposed remedy. This is particularly important given the long time frame over which this remedy must remain in place. Because the groundwater contamination covers literally thousands of separately-owned real property parcels, imposing direct institutional controls on real property throughout the entire distribution of groundwater contamination at the Joint Site would be impracticable.

Superfund regulations clearly state that, while institutional controls should be considered as a means for supplementing a remedy, they should not be relied upon as the sole remedy. The NCP, at §300.430(a)(1)(iii)(D), states,

> EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants...The use of institutional controls shall not substitute for active response measures (e.g. treatment and/or containment of source material, restoration of groundwaters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of the remedy.

Similarly, EPA notes that the NCP preamble, at 55 Fed. Reg. No. 46, p.8706, notes that:

> "...institutional controls may be used as a supplement to engineering controls over time but should not substitute for active response measures as the sole remedy unless active response measures are not practicable..."

This remedial action contains certain institutional controls to supplement the primary actions selected in this ROD, which include both containment and restoration of groundwater resources through treatment as preferred by the NCP. All alternatives other than No Action include the following institutional controls:

1. EPA would coordinate with the appropriate agencies regarding the existing legal and regulatory prohibitions and restrictions on groundwater use for the affected groundwater at the Joint Site.

2. At its sole discretion, EPA may issue administrative non-interference orders within its authority to ensure that actions taken by outside parties do not interfere with the Joint Site remedial action. Non-interference orders are administrative orders issued by EPA pursuant to CERCLA which direct a party to cease or desist from taking an action that would interfere with EPA's remedy, and/or to take actions specified in the order to prevent or mitigate such an interference. As an example, if a facility outside the periphery of the Joint Site has groundwater contamination is moving or will move into the Joint Site during the remedial action, EPA may issue an order directing that party to take actions that will prevent such interference. Likewise, if such a party were implementing its own groundwater cleanup using hydraulic extraction, and such extraction threatened to create hydraulic changes that would threaten the effectiveness of the remedial action selected by this ROD, EPA could issue such an order directing that the party cease and desist or modify its remedial actions in such a way that such interference is avoided.

3. EPA would perform well surveys to monitor groundwater use within the area of groundwater affected by contamination at the Joint Site. If well users within the area are found, EPA would inform such persons directly of the substantial health risk and also inform the State and local agencies which have jurisdiction and/or authority with respect to groundwater wells and groundwater usage within the Joint Site. Also, EPA may issue non-interference orders, at its discretion, to prevent or limit operation of wells which may be found to exist within the contaminated groundwater at the Joint Site in the future.

With respect to potential interferences from outside sources of contamination, in addition to issuance of non-interference orders as discussed above, EPA may consider amending this ROD to select specific remedial actions for such sources as part of the Joint Site, if EPA should determine that such actions become necessary during the remedial design or implementation of the remedial action.

Common Elements for the *Chlorobenzene* Plume

All of the alternatives (except No Action, Alternative 1) contain the following aspects with respect to the *chlorobenzene plume*:

- The volume of the chlorobenzene plume *outside the containment zone/TI waiver zone* that contains contaminants at concentrations above ISGS levels is reduced to zero.[3]
- This reduction of volume of the chlorobenzene plume *outside the containment zone/TI waiver zone* is accomplished by hydraulic extraction, treatment, and aquifer injection.
- The volume of the chlorobenzene plume *inside the containment zone/TI waiver zone*, surrounding the NAPL, is contained indefinitely. The extent of the TI waiver zone was identified in Section 10.
- The containment zone/TI waiver zone is contained by means of hydraulic extraction, treatment, and aquifer injection. NAPL itself is not removed as part of this remedy (unless incidental). Rather, water into which the NAPL has dissolved is removed and treated within a zone of groundwater which surrounds the NAPL.
- The majority of the hydraulic extraction will take place, in roughly balanced amounts, in the MBFC Sand and the Gage Aquifer. Some extraction will also take place in the Lynwood Aquifer.
- Aquifer injection of treated water. As discussed earlier, this is necessary for hydraulic control and to ensure that the movement of NAPL is not unreasonably induced by the pumping, and so it is included in all alternatives.
- Monitoring sufficient to confirm and evaluate the plume reduction outside the containment zone, the containment of the containment zone, movements of contaminants within the plumes, groundwater levels, gradients, hydraulics, effects of pumping, and other factors.
- Contingent hydraulic extraction in the event that contamination leaves the containment zone (to which the TI waiver is applied).

---

[3]Alternatives 2-5 differ in terms of the relative aggressiveness, or rate, that the cleanup of the chlorobenzene plume outside the containment zone would occur. These differences are discussed in Section 11.3, which discusses the differentiating aspects of the alternatives.

- A TI waiver applied to the MBFB Sand, MBFC Sand, Lower Bellflower, and Gage Aquifer. The Lynwood Aquifer is not included in the TI waiver and therefore Lynwood groundwater within the Joint Site will be restored to concentrations at or below ISGSs (See Section 10). The containment/TI waiver zone extends deeper within the chlorobenzene plume than within the benzene plume.

Common Elements for the *Benzene* Plume

The benzene plume lies entirely within the containment/TI waiver zone and so, under all alternatives considered other than the No Action Alternative, is not subject to volume reduction (e.g. shrinking the volume of water in the plume with contaminants at unacceptable concentrations), but rather containment. The basis for this was discussed in Section 10 of this ROD. The means used to contain the benzene plume varies among the alternatives, as is discussed in Section 11.4, following this section.

Under all alternatives except for No Action, this ROD sets a performance requirement that the benzene plume remain contained within the containment zone/TI waiver zone. Under all alternatives except No Action, if the benzene plume leaves the containment zone in the future, additional active hydraulic extraction and treatment of the benzene plume would be implemented to re-establish hydraulic containment of the benzene within the TI waiver zone.

The following are also components of all alternatives (except Alternative 1) for the ***benzene plume***:

- Monitoring sufficient to confirm and evaluate containment of the benzene plume, the movement of contaminants within the benzene plume, the continued effectiveness of intrinsic biodegradation within the benzene plume, groundwater levels, gradients, hydraulics, effects of pumping, and other factors.

- A TI waiver applied to the UBF, MBFB Sand and MBFC Sand, but not to the Gage or Lynwood Aquifers. See Section "Technical Impracticability ARAR Waivers" in this ROD. As described in that section, there is a single TI waiver zone for the Joint Site but it extends to a lesser depth for the benzene plume than for the chlorobenzene plume.

Common Elements for the *TCE* Plume

Under all alternatives, a performance-based approach is applied to the TCE plume, requiring that the TCE, like the benzene, remain contained within the containment zone (TI Waiver zone). Under this approach, as with benzene, if the TCE moves outside the containment zone, hydraulic extraction would be employed to re-establish containment. This contingent hydraulic extraction

would not take place under the benzene NAPL, but at the periphery of the containment zone; hence, risks of benzene movement would be minimized (See earlier discussion in Section 11.1).

The remedial action for the TCE plume in all alternatives, other than the No Action alternative, contains or addresses the following:

- The immediate sources of TCE contamination in the TCE plume (near solvent-using facilities upgradient of the MW-20 area) will be partially contained by pumping groundwater at low rates near these sources and treating it. This hydraulic extraction will not be directly under the benzene NAPL in the MBFB Sand, but will take place slightly upgradient of the NAPL. This hydraulic extraction will limit the highest concentrations of TCE, as well as TCE NAPL from migrating laterally and vertically, although it will not completely prevent the migration of the TCE.

- Treated water from this hydraulic extraction will be re-injected back into the aquifer to obtain the optimum flushing and ability to limit hydraulic influences on the neighboring benzene NAPL and/or chlorobenzene plume.

- Additional sampling during remedial design will confirm the exact size and nature of the TCE plume in the MBFC Sand for design purposes. If the data reveal unexpected information, adjustments to the remedy will be proposed and implemented by EPA, as necessary.

- On a performance basis, TCE that is currently within the containment zone (TI waiver zone, established as described earlier in this ROD) will not be allowed to leave the containment zone. While hydraulic extraction of the TCE in the MBFC Sand directly under the benzene NAPL in the MBFB Sand is not proposed, additional pumping wells downgradient of the TI waiver zone and/or under the MBFC Sand in the Gage Aquifer may be required to meet this performance requirement and such needs will be assessed during the remedial design phase.

As this action for the TCE plume does not further vary among the alternatives, it is not further described in the discussion differentiating the alternatives that follows.

Actions for the Contaminant pCBSA

All alternatives, except for the No Action alternative, contain the following actions with respect to the compound pCBSA. The rationale for taking these actions is presented in Section 12, however, as some of the information in the remainder of Section 11 provides part of the basis for this action. However, the actions for pCBSA are noted here so that all common-elements can be listed together.

pCBSA is being addressed separately from all other contaminants by this remedial action. Therefore, the requirements specified elsewhere in this ROD for the chlorobenzene, benzene, and TCE plumes do not apply to pCBSA. All alternatives other than the No-Action alternative contain the following actions for pCBSA. Section 12 provides much more detail on the rationale for this action.

- The concentration at which pCBSA is re-injected into the ground shall be limited to 25,000 ppb. The State of California holds that 25,000 μg/l can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

- The full downgradient extent of pCBSA contamination shall be determined and the movement of pCBSA shall be routinely monitored.

- Sampling at potentially susceptible public production wells shall include analyses for pCBSA.

- Well surveys shall be routinely updated to identify any new wells which may lie within the pCBSA distribution.

- At the Superfund 5-year reviews required by law, EPA will re-evaluate whether additional toxicological studies have been performed for pCBSA, assess the extent of the pCBSA plume and make determinations as to whether the remedy remains protective with respect to pCBSA.

It should be noted that the 25,000 ppb limit on aquifer injection of treated water mentioned above is ***not*** an in-situ standard. Therefore, this value does not represent an ISGS value. This ROD standard applies to the action of aquifer injection after groundwater is withdrawn and treated; it does not imply that groundwater in the ground will be cleaned to this value.

11.4 Differentiating Description of Alternatives

A summary of major elements of alternatives is shown in Figure 11-1, and in Table 11-1. These figures greatly facilitate the discussion in this subsection as well as the previous subsection. Figure 11-1 is arranged visually by hydrostratigraphic unit. It provides a summary of both the common and differing elements of the alternatives in terms of how the containment zone is contained, and the means by which the contaminant concentrations in any portion of the plume outside the containment zone are reduced (the volume of the plume reduced) so as to attain ISGS concentration levels within the aquifer. Table 11-1 provides similar information in tabular format, but also shows information related to the TCE plume, aquifer discharge methods, and cost, which are not shown on Figure 11-1 for simplicity. It is noted that Table 11-2 contains more detailed cost information than Table 11-1.

A description of elements that are common among the alternatives was provided above. The following discussion provides a description of the differing elements of the alternatives that were considered as part of the remedial action selection process. The representative technologies and discharge options are also shown for each alternative. Further discussion of the treatment technologies and discharge options are discussed in the next section. Because the action for the TCE plume is common to all alternatives, it is not discussed in this section.

Detailed and overall cost information that is cited in the following discussion is summarized in Table 11-2 of this ROD.

Alternative 1

Alternative 1 is No Action. Under this alternative, no remedial action would be taken, and no monitoring would occur. It has no cost in terms of remedial actions, although there would clearly be a cost to society from the continued loss of the groundwater resource and the potential for human exposure to site contaminants. Contamination would continue to move unchecked and unmonitored. NAPL would continue to contaminate groundwater. Potential health risks, if realized, would not be abated. Existing groundwater contamination would remain indefinitely, on the order of several centuries, and would potentially continue to impact new areas.

Introduction to Alternatives 2 Through 5

The four active alternatives (2-5) differ in key respects with respect to the chlorobenzene plume and benzene plume, respectively.

Chlorobenzene Plume

Alternatives 2 through 5 differ in terms of the relative *aggressiveness,* or *rate,* with which the chlorobenzene plume *outside* the containment zone is reduced in volume. Three groundwater extraction rates for the chlorobenzene plume are reflected in alternatives 2-5: 350 gallons per minute (gpm), 700 gpm, and 1400 gpm. In the JGWFS, these pump rates represent the *Plume Reduction 1, Plume Reduction 2, and Plume Reduction 3 scenarios* for the chlorobenzene plume. In general, the higher the pump rate, the faster the cleanup would occur, and the greater the flushing of the pore spaces in the aquifer by the remedial action.

Each of these scenarios was modeled in the JGWFS using differing wellfields. While the basic structure of each of these wellfields was the same, the numbers of extraction and injection wells were increased as the overall target pumping rate being simulated was increased. *It should be noted that these wellfields are not selected by this ROD; wellfields will be adjusted during the remedial design phase.* Those wishing to see the wellfields used in the JGWFS should view Section 5 or Appendix B of the JGWFS.

Figure 11-2 shows the performance of each alternative at removing the chlorobenzene plume outside the containment zone at simulated time frames of 10, 25, and 50 years. The primary relative basis of comparison used in the text which follows is the 25 year simulation. It is noted that pore volume flushing rate magnitudes and distributions can be found in Section 5 of the JGWFS.

Benzene Plume

Alternatives 2 through 5 differ in terms of the means by which the benzene plume is contained (as discussed in Section 10, the entire benzene plume is within the containment zone). In Alternative 2, the benzene plume is contained in all units by reliance on monitored intrinsic biodegradation. In Alternatives 3, 4 and 5, the benzene plume is contained in the UBF and MBFB sand by reliance on monitored intrinsic biodegradation, but is contained in the MBFC Sand by active hydraulic extraction and treatment. This was called ***hybrid containment*** in the JGWFS because both methods were used to contain the benzene plume, depending on the hydrostratigraphic unit.

EPA eliminated from further consideration alternatives that would have relied on intrinsic biodegradation for the MBFC Sand in the benzene plume while the chlorobenzene plume was

pumped at the higher 700-gpm and 1400-gpm pump rates. This was because there was too much uncertainty that intrinsic biodegradation could keep the benzene plume contained in the MBFC Sand if the chlorobenzene plume is pumped at these rates.

Alternative 2
350 gpm for Chlorobenzene / Containment by Intrinsic Biodegradation for Benzene

Under Alternative 2, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **350 gpm**. Because of this low pump rate, the time to complete the remedy is the longest of any of the alternatives (excluding No Action, in which a cleanup is not undertaken). After 25 years, the model predicts that somewhat less than one third of the volume of the chlorobenzene plume (with concentrations above drinking water standards) would be removed. From Figure 11-2, it can be seen that Alternative 2 removes very little of its contamination in the early years of operation. Thus, Alternative 2 exhibits relatively poor early time performance.

The area with measurable and significant pore volume flushing under Alternative 2 is limited to about one half the size of the chlorobenzene plume and the spatial coverage of significant pore volume flushing is sporadic. Significant areas of the chlorobenzene plume, therefore, will be flushed at low rates and other areas will virtually not be flushed at all.

Under alternative 2, the benzene plume would be contained in the UBF, the MBFB Sand, and the MBFC Sand through reliance on monitored intrinsic biodegradation.

The cost of Alternative 2 would be $21,353,000.[4]

Alternative 3
350 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 3, as with Alternative 2, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **350 gpm**. As with Alternative 2, after 25 years, the model predicts that somewhat less than one third of the volume of the chlorobenzene plume with concentrations above ISGS

[4] Cost values given below differ slightly from those in the JGWFS because they have been corrected after a spreadsheet error was discovered in the JGWFS during the public comment period. The cost estimates change by the following amounts due to this error: Alternative 2, 2.4 percent; Alternative 3, 2.0 percent; Alternative 4, 1.7; and Alternative 5, 1.6 percent. These amounts are not considered significant relative to the -30%/+50% cost estimating used for feasibility study purposes. For more information on this error, see Response Summary.

levels would be removed. Alternative 3 has the same characteristics as Alternative 2 with respect to total relative time to meet objectives, early time performance, and pore volume flushing.

Under alternative 3, the benzene plume would be contained in the UBF, and the MBFB Sand through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment*.

The cost of Alternative 3 would be $26,481,000.

Alternative 4
700 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 4, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **700 gpm**, as opposed to 350 gpm in Alternatives 2 and 3. Alternative 4 would stop the chlorobenzene plume from spreading almost immediately and begin to reduce its size. The higher 700 gpm pump rate provides for excellent early time performance (a large percentage of the plume is removed in early years of operation), and a shorter overall cleanup time, compared to Alternatives 2 and 3. At 25 years, the model predicts that slightly more than two-thirds of the chlorobenzene plume with concentrations above ISGS levels would be removed. The pore volume flushing by this Alternative is greater in magnitude (flushing rates of 1 pore volume per year and higher are achieved in the chlorobenzene plume, and pore volume flushing covers the entire plume).

Under alternative 4, as with Alternative 3, the benzene plume would be contained in the UBF, the MBFB Sand only through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment*.

The cost of Alternative 4 would be $30,490,000.

Alternative 5
1400 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 5, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **1400 gpm**. After 25 years, the model predicts that about 90 percent (varies between MBFC Sand and Gage Aquifer) of the volume of the chlorobenzene plume with concentrations above ISGS levels would be removed. Based on these estimates, the total time to reach remedial objectives would be the least among the alternatives. The early time performance of Alternative 5 is excellent and is the

best of any of the alternatives. The pore volume flushing under Alternative 5 is greater in magnitude and in extent than Alternative 4; in fact, it was simulated to create appreciable pore volume flushing over an area larger than the chlorobenzene plume (this excess, however, would be removed during the remedial design process if Alternative 5 were designed and implemented).

Under alternative 5, as with Alternatives 3 and 4, the benzene plume would be contained in the UBF, the MBFB Sand only through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment.*

The cost of Alternative 5 would be $40,514,000.

11.5 Treatment Technologies and Treated Water Discharge

Each of the alternatives considered by EPA in the JGWFS, except for Alternative 1, No Action, employs treatment of extracted groundwater for one or more areas of groundwater. The treated groundwater must be discharged in some manner.

Locations of Treatment and Number of Treatment Plants

The JGWFS makes reasonable assumptions as to the number and locations of groundwater treatment plants so as to make reasonable estimates of costs associated with the alternatives. Three treatment plants were assumed, one for each plume, for alternatives 3, 4 and 5. For Alternative 2, in which no active hydraulic containment is assumed for the benzene plume in the MBFC Sand, only two plants are assumed. For Alternative 1, No Action, no plants are assumed. However, this ROD does not select the number of treatment plants, wellfields, nor pump rates at individual wells, and these will be set in remedial design.

Primary Treatment Technologies

The primary differences among the remedial alternatives considered by EPA lie in what each alternative is able to accomplish in the ground rather than which technology is used to accomplish treatment of the extracted water. Treatment technologies were thoroughly evaluated as part of this remedy selection process, taking into account each of the plumes from which water would be extracted. However, this ROD selects several possible technologies to be available in remedial design.

Primary treatment technologies were those which were deemed capable of attaining ISGS levels in the groundwater outside the containment zone with respect to the contaminants in groundwater. Such technologies would also be capable of treating water drawn from *inside* the

containment zone (in the process of containment of the containment zone) to discharge standards. Additional *ancillary treatment technologies* were evaluated subsequently in order to ensure compliance with treated water discharge requirements (ancillary technologies are discussed following this subsection). The primary technologies identified in the JGWFS, after screening, to address the Joint Site contaminants are (1) liquid phase and vapor phase carbon adsorption, (2) air stripping, and (3) fluidized bed reactor. These are shown on Figure 11-3. With **liquid phase adsorption**, the water coming into the treatment plant is run through a bed of activated carbon, which adsorb the contaminants out of the water. When the carbon can no longer adsorb more contaminants, the carbon is said to be saturated. The saturated carbon can be sent offsite and reactivated, or regenerated, which allows the contaminants to be safely recovered and destroyed, and the carbon beads can be reused. Alternatively, the carbon can be sent to a landfill designed and approved to receive hazardous waste. **Liquid phase granular activated carbon** is the form of liquid phase adsorption most likely to be cost-effective at the Joint Site. With **air stripping**, the water is contacted with air and the volatile contaminants are transferred into the air. The air is then passed through a **vapor phase carbon adsorption** system that transfers the contaminants from the air to the carbon, similar to what occurs in liquid phase adsorption. The clean air is then discharged back into the atmosphere. With **fluidized bed reactor**, the contaminated water is passed through a agitated bed which has carbon with a biological film , or biofilm, on it. The bacteria in the biofilm metabolize and degrade most of the contaminants into carbon dioxide, water, and hydrochloric acid. There is the need to dispose of a portion of the biological mass that grows in the biofilm. When necessary, the biological mass is concentrated, dewatered, and disposed offsite in accordance with independently applicable laws and requirements.

Treatment Trains

The JGWFS did a screening and evaluation of these technologies, taking into account the water quality, approximate pumping locations and pump rates, and discharge options to be applied. Primary treatment technologies were assembled into treatment trains.

From the three primary technologies, EPA considered three treatment trains for the chlorobenzene plume, three treatment trains for the benzene plume, and two treatment trains for the TCE plume. These are:

- Chlorobenzene Plume:

    Carbon adsorption alone
    Air stripping followed by carbon adsorption polishing and vapor phase adsorption
    Fluidized bed reactor followed by carbon adsorption polishing

- Benzene Plume:

  Carbon adsorption alone
  Air stripping followed by carbon adsorption polishing and vapor phase adsorption
  Fluidized bed reactor followed by carbon adsorption polishing

- TCE Plume:

  Carbon adsorption alone
  Air Stripping followed by vapor phase carbon adsorption

These basic treatment trains were further enhanced by ancillary technologies shown in Table 11-3 and discussed below, to form the complete treatment trains, as shown in Table 11-4.

Ancillary Technologies

Ancillary technologies are those required to treat extracted groundwater to reduce the concentration of naturally-occurring species in the water to meet regulatory standards and engineering requirements associated with the discharge of the water. The JGWFS identified the major such ancillary technologies anticipated to be necessary in the alternatives, and incorporated them in the treatment trains evaluated for each plume in the JGWFS. As an example, the natural level of copper in the benzene plume is slightly too high to meet standards for discharge to a storm channel, the discharge option for water treated from the benzene plume in the MBFC Sand. Ancillary technologies identified in the JGWFS include those that may be necessary to reduce ambient copper levels in groundwater prior to injection into a storm water system, reduce total dissolved solids prior to re-injection, or prevent scaling or fouling of injection wells. These are shown in Table 11-3. These technologies shall be used in the remedial action where necessary and shall be considered available in remedial design. Ancillary technologies shall be used only to the extent that the remedial design requires them.

Cost-representative Treatment Train versus Selection of Multiple Technologies

For each plume, a ***cost-representative treatment train*** was identified in the JGWFS. In each case, the cost-representative treatment train was the least costly option using the assumptions used by the JGWFS and after determining largely equal ability of all the treatment trains to meet regulatory requirements, including ARARs. For purposes of estimating costs, the cost-representative treatment train was assumed to be used for each plume. In this way, the costs of all alternatives could be compared on an even basis.

For all three plumes, the JGWFS identified Carbon Adsorption Alone (with ancillary treatments as necessary) as the *cost-representative treatment*. Accordingly, the cost estimates of alternatives in the JGWFS assumed that Carbon Adsorption Alone was the treatment. EPA's calculations indicate that Carbon Adsorption Alone is likely to be the most cost-effective option for each plume once the remedy is designed. However, the JGWFS does provide sufficient information to determine the cost of an alternative primary treatment technology in the event that a different treatment train were used.

By identifying a cost-representative treatment, this ROD does not intend to limit the remedial design to this one treatment method. Rather than selecting a single treatment technology or treatment train for each plume, this ROD selects the entire range of treatment trains, and the primary technologies which passed screening, as available in remedial design to address each plume. This is to allow for maximum flexibility in the design. This ROD identifies all ARARs that shall apply to these technologies, in Appendix A to this ROD.

Supplemental Technologies

In addition to the primary treatment trains, and ancillary technologies, the JGWFS identified other technologies which survived screening and could be added to the treatment trains in modular fashion, if determined necessary in remedial design or during the course of the remedial action. It is not intended that these additional technologies be available as wholesale alternatives (replacements) to the primary treatment trains identified above. Switching the entire treatment to one of these additional technologies could imply a dramatic change in the cost of the remedial action which was not evaluated as part of the Feasibility Study or remedial action selection process. However, such ***supplemental technologies*** could be added to the remedial action for certain portions of groundwater, for certain times during the remedial action, to address problems or issues with might arise, or to increase the efficiency of the remedial system already in place. These supplemental technologies should be considered available in remedial design as determined necessary by the remedial design. The supplemental technologies considered in the JGWFS include ***liquid-gravity separation*** and ***advanced oxidation processes.***

Discharge Options

As discussed earlier in this section, aquifer injection is considered the essential disposal option for the treated water for the chlorobenzene plume and the TCE plume. This is to provide hydraulic control and limit the potential for NAPL movement. Therefore, no other discharge options were evaluated in detail by EPA for the chlorobenzene and TCE plumes. However, three discharge options were evaluated for the benzene plume, for alternatives where the benzene plume is subject to hydraulic extraction. These are: (1) aquifer injection, (2) discharge to the storm drain, and (3) disposal to the sanitary sewer. Discharge to the Storm Drain was the representative discharge

option used in the remedial alternatives for the benzene plume. The basis for this is described in the JGWFS, Section 7.

As with the primary technologies and treatment trains just discussed, by selecting a representative discharge option, this ROD does not intend to restrict the discharge options for the benzene plume to only storm water discharge. Any of the three discharge options identified shall be available in the remedial design, provided all discharge ARARs and other requirements are met by the implemented remedial action.

The ISGS levels established in Section 9 of this ROD apply to the in-situ groundwater. However, in order to ensure protectiveness of human health and the environment, and ensure progress toward meeting ISGS levels in-situ in groundwater, treated groundwater shall not be injected into aquifers at the Joint Site as part of this remedial action at concentrations which exceed the ISGS levels.

Table 11-1
Description of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Faster Cleanup → → →

	Alternative 1 "No Action"	Alternative 2	Alternative 3	Alternative 4	Alternative 5
CHLOROBENZENE PLUME					
Approximate Rate of Hydraulic Extraction	No action	350 gallons per minute	350 gallons per minute	700 gallons per minute	1,400 gallons per minute
Method of Hydraulically Isolating NAPL Area	No containment of the NAPL area	Extracting and treating the groundwater	Extracting and treating the groundwater	Extracting and treating the groundwater	Extracting and treating the groundwater
Where is the Treated Water Discharged?	No action, thus no discharge	Aquifer injection	Aquifer injection	Aquifer injection	Aquifer injection
BENZENE PLUME					
Approximate Rate of Hydraulic Extraction	No action	No hydraulic extraction for benzene plume	Approximately 40 gallons per minute	Approximately 40 gallons per minute	Approximately 40 gallons per minute
Method of Hydraulically Containing Benzene Plume	No containment of the benzene plume	Contain benzene plume in all units with intrinsic biodegradation	Contain the UBF and MBFB Sand with intrinsic biodegradation Contain the MBFC Sand with extracting and treating the groundwater	Contain the UBF and MBFB Sand with intrinsic biodegradation Contain the MBFC Sand with extracting and treating the groundwater	Contain the UBF and MBFB Sand with intrinsic biodegradation Contain the MBFC Sand with extracting and treating the groundwater
Where is the Treated Water Discharged?	No action, so no discharge	No treated water to discharge	Storm Drain	Storm Drain	Storm Drain
TCE PLUME					
What is Done? (Same in all alternatives except No. 1)	No action	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone

Table 11-1 - CONTINUED
Description of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

		Faster Cleanup →		→	→
	Alternative 1 "No Action"	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
COSTS OF THE ALTERNATIVES					
Total 30-Year Present Worth*:	$0	$21,353,000	$26,481,000	$30,490,000	$40,514,000
Capital Cost:	$0	$12,402,000	$13,976,000	$16,028,000	$22,049,000

☐ EPA's Preferred Alternative

*Costs are calculated as 30-year present worth, even though the true duration of the remedy is likely to be greater than 30 years. This is reasonable because the present worth value of the dollar after 30 years is small under a reasonable depreciation rate. For instance, EPA ran calculations which showed that if the cost basis were extended to 100 years, instead of 30 years, the total present worth value would increase by only about 12 percent, assuming a 5-percent depreciation rate. Because the true total time to clean up cannot be known exactly (time frames for alternatives are compared on a relative, not absolute, basis) EPA believes that the 30-year present worth value is an acceptable estimate and basis for comparison of the total costs of the alternatives in this case.

Table 11-2
Costs of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Alternative	Cost Summary	Monitoring	Benzene Hybrid Containment	Chlorobenzene Plume Reduction	TCE Plume Reduction	Total Cost Summary
2	Capital	$806,000	$0	$8,989,000	$2,607,000	$12,402,000
	Present Worth O&M	$2,057,000	$0	$4,338,000	$2,180,000	$8,575,000
	Present Worth Equipment Replacement	97,000	0	155,000	124,000	376,000
	Total Present Worth	**$2,960,000**	**$0**	**$13,482,000**	**$4,911,000**	**$21,353,000**
3	Capital	$806,000	$1,574,000	$8,989,000	$2,607,000	$13,976,000
	Present Worth O&M	$2,057,000	$3,381,000	$4,338,000	$2,180,000	$11,956,000
	Present Worth Equipment Replacement	97,000	173,000	155,000	124,000	549,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$13,482,000**	**$4,911,000**	**$26,481,000**
4	Capital	$806,000	$1,574,000	$11,041,000	$2,607,000	$16,028,000
	Present Worth O&M	$2,057,000	$3,381,000	$6,237,000	$2,180,000	$13,855,000
	Present Worth Equipment Replacement	97,000	173,000	213,000	124,000	607,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$17,491,000**	**$4,911,000**	**$30,490,000**
5	Capital	$806,000	$1,574,000	$17,062,000	$2,607,000	$22,049,000
	Present Worth O&M	$2,057,000	$3,381,000	$10,141,000	$2,180,000	$17,759,000
	Present Worth Equipment Replacement	97,000	173,000	312,000	124,000	706,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$27,517,000**	**$4,911,000**	**$40,514,000**

Notes: Present worth operations & maintenance (O&M) costs calculated at 5-percent discount rate for 30 years.

Costs are calculated as 30-year present worth, even though the true duration of the remedy is likely to be greater than 30 years. This is reasonable because the present worth value of the dollar after 30 years is small under a reasonable depreciation rate. For instance, EPA ran calculations which showed that if the cost basis were extended to 100 years, instead of 30 years, the total present worth value would increase by only about 12 percent, assuming a 5-percent depreciation rate. Because the true total time to clean up cannot be known exactly (time frames for alternatives are compared on a relative, not absolute, basis) EPA believes that the 30-year present worth value is an acceptable estimate and basis for comparison of the total costs of the alternatives in this case.

Table 11-3
Ancillary Treatment Technologies
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Control Requirement	Treatment Technologies	
Heavy Metals Removal	–	Iron Coprecipitation: (benzene plume storm drain discharge)
Mineral Scale Control	– – –	pH Adjustment Lime Softening: (benzene plume injection) Antiscalent (sequestering agent) Addition: (all plumes, all discharge options)
pH Control	– –	Carbon Dioxide Addition (all plumes following air stripping) Mineral Acid Addition (Benzene plume storm drain discharge following iron coprecipitation)
Biological Slime Control	–	Bleach Addition (all plumes, all discharge options)
Suspended Solids Control	– – –	Clarifiers (where applicable) Media Filtration (where applicable) Fine Filtration (all plumes, all discharge options)

Table 11-4
Treatment Trains

Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Chlorobenzene Plume

Air Stripping Followed by LGAC Adsorption and VGAC for Offgas Treatment

LGAC Adsorption

Fluidized-Bed Reactor Followed by LGAC Adsorption

Benzene Plume

Air Stripping Followed by Iron Coprecipitation, LGAC Adsorption, and VGAC for Offgas Treatment

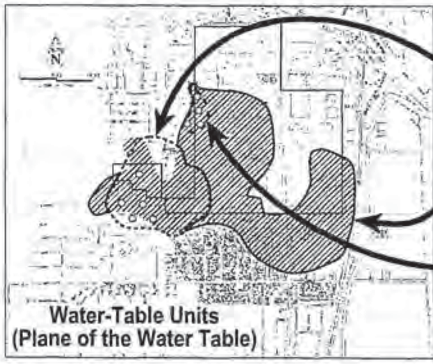
LGAC Adsorption with Iron Coprecipitation

Fluidized-Bed Reactor Followed by Iron Coprecipitation and LGAC Adsorption

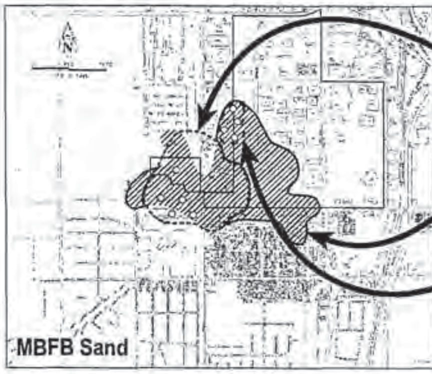
TCE Plume

Air Stripping Followed by LGAC Adsorption and VGAC for Offgas Treatment

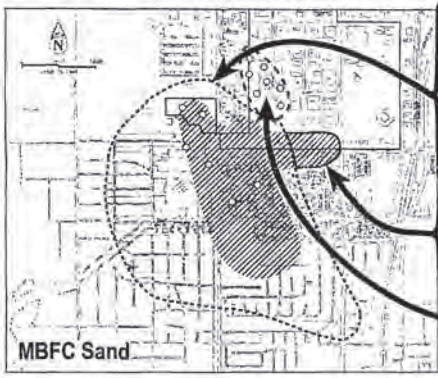
LGAC Adsorption



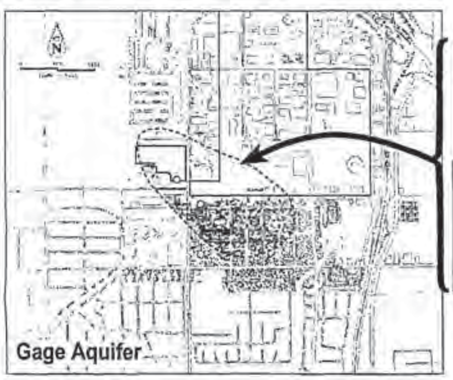
Water-Table Units	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Chlorobenzene plume†	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection
Benzene plume‡† (lies within the UBF)	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation
TCE plume†	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone



MBFB Sand	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Chlorobenzene plume†	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection
Benzene plume‡†	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation
TCE plume†	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone



MBFC Sand	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Chlorobenzene plume† (within the containment zone)	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection
Chlorobenzene plume† (outside the containment zone)	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 700 gpm using hydraulic extraction and injection*	Reduction at 1,400 gpm using hydraulic extraction and injection*
Benzene plume‡†	Contain with monitored intrinsic biodegradation	Contain with hydraulic extraction and injection+	Contain with hydraulic extraction and injection+	Contain with hydraulic extraction and injection+
TCE plume†	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone



Gage Aquifer	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Chlorobenzene plume† (within the containment zone)	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection
Chlorobenzene plume† (outside the Containment Zone)	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 700 gpm using hydraulic extraction and injection*	Reduction at 1,400 gpm using hydraulic extraction and injection*

= Principal Differing Elements of Alternatives

Alternative 1, No Action, implies no actions and is not shown.

† The term "plume" has a meaning specifically defined by convention in this ROD; see Sections 5 and 7 of this ROD.

‡ The benzene plume in all units, and the chlorobenzene plume in the MBFB Sand, are entirely within the NAPL containment zone.

+ It is noted that water withdrawn from the benzene plume itself may not be suitable for discharge by aquifer injection depending on the well locations determined in the final remedial design. However, aquifer injection of water drawn from other locations (e.g. the chlorobenzene plume) may be used to assist in the containment of the benzene plume.

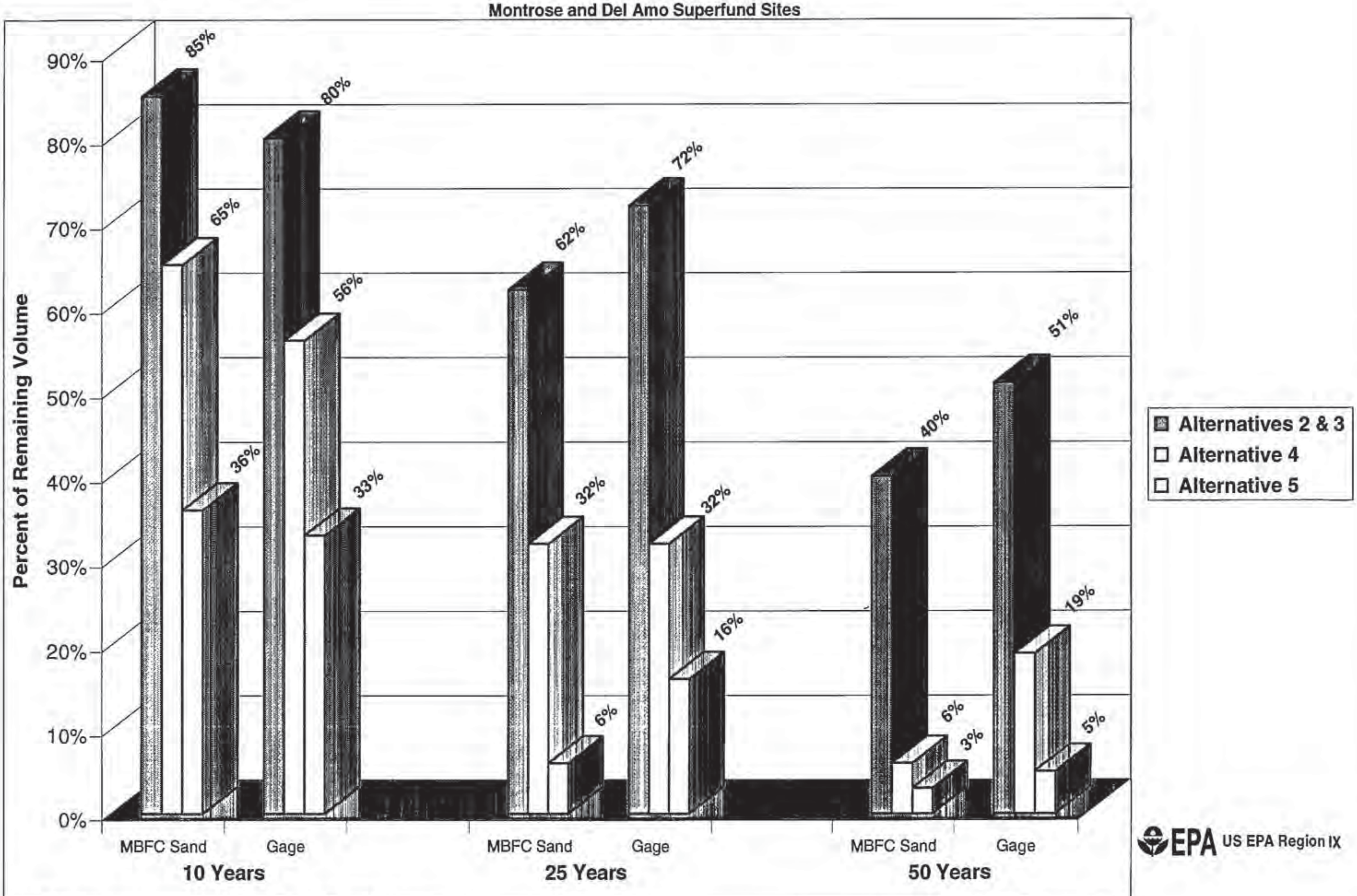
* The pump rate shown is the total plume reduction pump rate for the scenario. Not all of this pumping would occur in the unit shown. This ROD selects other performance criteria other than pump rate, and the pump rate is used here only to designate the relative aggressiveness of the alternative.

Note: Lynwood Aquifer contamination will be reduced and eliminated entirely by hydraulic extraction. There is no NAPL containment zone in the Lynwood Aquifer.

Figure 11-1
Summary of Remedial Actions for Each Plume by Alternative
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

Figure 11-2
Percent of Remaining Volume of the Chlorobenzene Plume[1]
by Alternative in 10, 25, and 50 Years
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites



[1] The dissolved chlorobenzene outside the DNAPL containment zone

US EPA Region IX

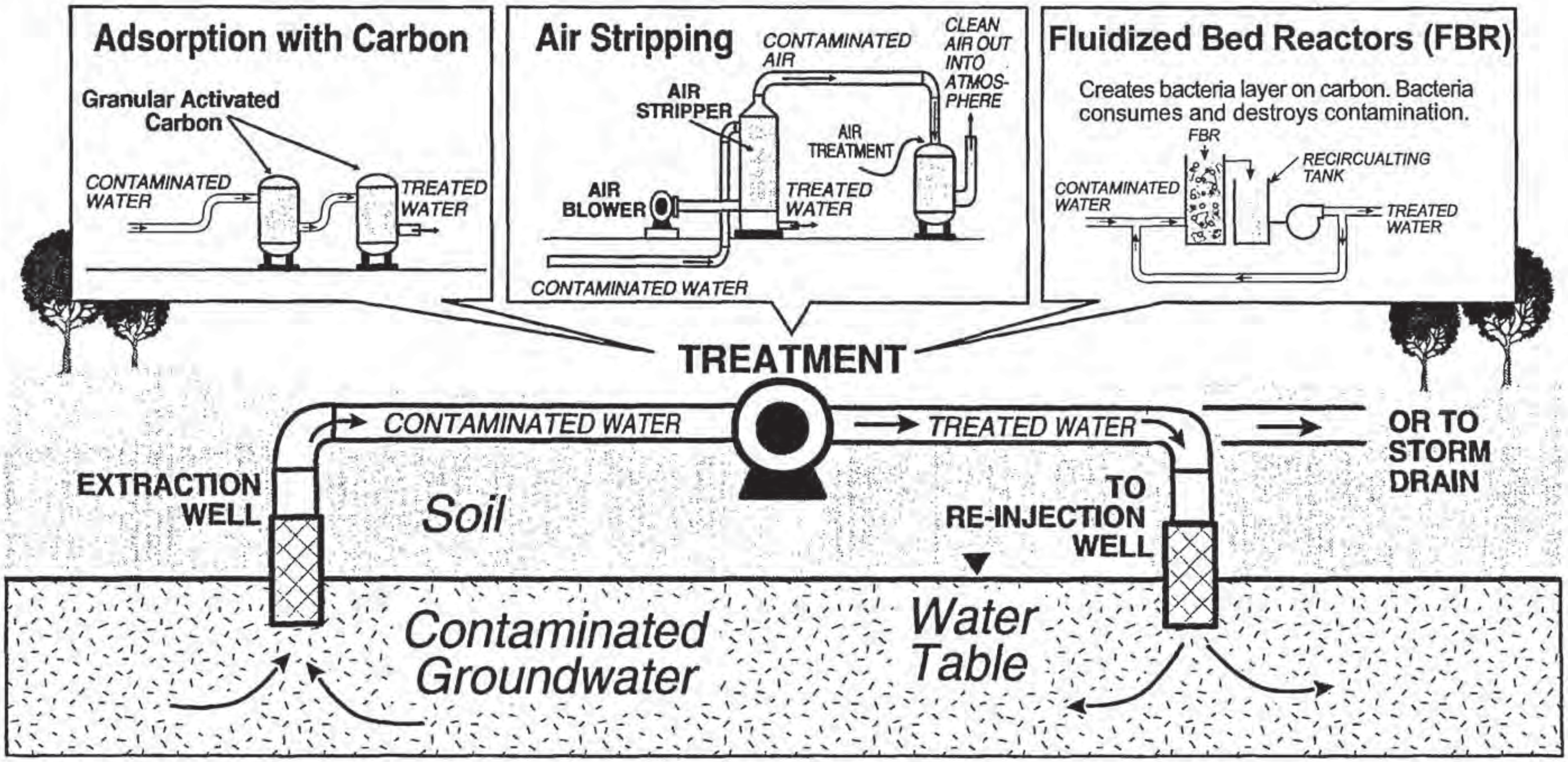


Figure 11-3
Treatment Technologies
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

12. Summary of Comparative Analysis of Alternatives & Rationale for Selected Alternative

This section of the ROD presents EPA's comparison of alternatives, and documents the rationale for other elements of EPA's decision. The reader should also consult the Response Summary of this ROD for further documentation of how EPA addressed issues related to the selection of the remedial action.

The NCP requires that EPA utilize nine criteria in comparing and selecting remedial alternatives. These are:

- Protectiveness of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long Term Effectiveness
- Short-Term Effectiveness
- Reduction of Mobility, Toxicity and Volume of Contaminants Through Treatment
- Implementability
- Cost
- State Acceptance
- Community Acceptance

[40 C.F.R. §300.430(f)(1)(i)]

The first two criteria are usually referred to as threshold criteria; the next five criteria are usually referred to as balancing criteria; and the last two are referred to as modifying criteria. The following evaluates the five alternatives discussed in Section 11 of this ROD in terms of these criteria.

As with the previous section, the following discussion does not focus on elements that are

common to all alternatives. The cost estimates in the following discussion are based on the JGWFS and are approximate values intended to be within +50%/-30% of the actual values.[1] We note that this section does not repeat analyses included in previous sections of this ROD, including but not limited to the basis for using a dual-site approach and the context of this remedial action, the rationale for imposing a containment zone, rationale for the size and extent of the TI waiver zone, etc. Discussions of these matters can be found in the earlier sections.

12.1 Protectiveness of Human Health and the Environment

Protectiveness of Human Health and the Environment is generally considered a threshold criterion [40 C.F.R. §300.430(f)(1)(i)(A)]. EPA has addressed this criterion in two ways. Presently, and as a matter of threshold, all alternatives other than the No Action Alternative would be protective of human health and the environment. However, while each of the alternatives, except for the No Action Alternative, has the potential to attain remedial action objectives, it would be misleading to represent that the alternatives are certain to attain, or have equal certainty of attaining, the objectives of (1) reducing the concentrations of contaminants to ISGS levels at all points outside the containment zone, and of (2) maintaining the containment or contaminants within the containment zone. Because the time frame of the remedy is so long, there cannot be absolute certainty that these objectives will be met in the long term. The degree of certainty varies with the length of time the remedial action will take, the degree of early time performance, and the magnitude and distribution of pore volume flushing rates . Therefore, in addition making a threshold statement, EPA also compared the alternatives in balancing fashion with respect to the *degree* of certainty that, at the conclusion of the remedial action, all remedial action objectives will have been attained, and that the remedial action will remain protective over the long term.

In general, in dealing with extensive time frames, the longer the time required for a remedial alternative to meet remedial action objectives, the greater is the uncertainty that it will ultimately and fully meet those objectives at all. This is true because of the enormous degree of change that can occur in human (e.g. social, demographic, resource use, etc.) and natural (e.g. groundwater gradients, flow, water levels) conditions over the course of such time periods. As an example, demographic and in turn, water use patterns and distributions may change. The demand for water and the nature of water use may shift with social, economic, or political factors. It is not possible to reliably predict the manner in and degree to which these factors will change over the course of

[1] Cost values given below differ slightly from those in the JGWFS because they have been corrected after a spreadsheet error was discovered in the JGWFS during the public comment period. The cost estimates change by the following amounts due to this error: Alternative 2, 2.4 percent; Alternative 3, 2.0 percent; Alternative 4, 1.7 percent; and Alternative 5, 1.6 percent. These amounts are not considered significant relative to the -30%/+50% cost estimating used for feasibility study purposes. For more information on this error, see the Response Summary.

a century or more. This point can be illustrated by considering a comparison of 1999 to 1899 with respect to population and resource use patterns, or considering the capability of a person in 1899 to predict such patterns as they exist today. The assumptions of the analyses of a feasibility study, both written and implicit, assume generally greater uncertainty as the intervening time frame becomes very long. Accordingly, in this case, EPA considered alternatives likely to have shorter cleanup times to be characterized by greater certainty of meeting long-term remedial action objectives, and hence greater certainty of long term protectiveness of human health and the environment.

Likewise, because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the early period that is associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool, and this also affords greater certainty that the remedial objectives ultimately will be attained. In contrast, alternatives with poor early time performance do most of the removal of contamination late, when uncertainties as to future conditions are larger, and at points in time which cannot be simulated accurately by the model.

An additional benefit of early time performance is that more of the restored groundwater resource is usable sooner. The larger the area of groundwater that has been restored to drinking water standards, and the sooner this area grows in size, the less opportunity there is over time for use to be made of water that would pose an unacceptable health risk. Early time performance therefore affords greater certainty of long-term protectiveness.

Finally, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of pore volume flushing, provide better long-term certainty of protectiveness than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide (1) faster cleanup rates, (2) higher certainty that ARARs and remedial objectives will ultimately be achieved at all points in the plume, and in turn superior protection of human health in the long term.

In light of the foregoing discussion, the No Action Alternative would not be protective of human health and the environment either presently or in the long term.[2] Alternative 2 has the least degree of certainty as to long-term protectiveness, followed by Alternative 3, Alternative 4, and

[2]EPA finds the basis for action sufficiently compelling in this case, and also finds it feasible based on the JGWFS to take action in a manner which will not pose unacceptable short-term problems, to reject the No Action Alternative. However, EPA did evaluate it fully in the JGWFS as required by the NCP as a benchmark of comparison.

Alternative 5, in that order. Issues related to certainty of long-term protectiveness fall largely in two categories: (1) regarding reduction of the chlorobenzene plume outside the containment zone, and (2) regarding certainty of long-term containment of the benzene plume, which lies entirely within the containment zone. Clearly, the greater the uncertainty that ISGS levels will ultimately be attained at all points in the chlorobenzene plume outside the containment zone, the greater the uncertainty in the long term protectiveness of the remedial action. Similarly, the greater the uncertainty that long-term containment of the benzene plume can be maintained, the greater is the chance that contaminants will escape the zone, thwarting efforts to clean groundwater outside the containment zone to ISGS levels. This also would result in greater uncertainty of long-term protectiveness.

It is noted that all alternatives (other than No Action) perform similarly with respect to long term containment of the portion of the *chlorobenzene* plume that lies within the containment zone.

Long Term Certainty of Protectiveness in Relation to Reduction of the Chlorobenzene Plume Outside the Containment Zone

Because of its relatively low total groundwater extraction rate and lower number of extraction wells, Alternative 2 would take the longest of all the alternatives to reach cleanup standards. This long time frame results in the least certainty that ISGS levels ultimately will be attained at all points in the plume. Alternative 2's performance (percent of plume removed) at 25 years is the poorest of the alternatives. In addition, in simulations of Alternative 2, the magnitude of the increase in pore volume flushing is very small, and the area where increased pore volume flushing occurs covers only about 50 percent of the chlorobenzene plume. This greatly decreases the certainty that ISGS levels would be attained at all points in the plume in the long term. Alternative 2 has poor early time performance, again resulting in lower certainty of long-term protectiveness. Very little of the plume is removed during the time in which the model is an acceptable predictive tool. In addition, much more of the plume remains over the course of the remedial action, implying a larger contaminated area as time progresses, which in turn increases the chance that contaminated groundwater could be used over a long time frame. Alternative 3 has the same characteristics as Alternative 2 with respect to the characteristics just discussed.

Alternative 4, and to a greater extent, Alternative 5, because of their higher groundwater extraction rates and greater numbers of wells, imply much shorter cleanup times. Performance in terms of percent of the plume removed at 25 years for Alternative 4 more than double that for Alternatives 2 and 3. In simulations of Alternatives 4 and 5, pore volume flushing rates are much higher, more consistent, and more evenly- and completely-distributed over the chlorobenzene plume than for Alternatives 2 and 3. The early-time performance of Alternative 4 is much better than Alternatives 2 and 3, and still better in Alternative 5. These aspects lend much greater certainty that ISGS levels will be attained throughout the plume outside the containment zone,

end hence, greater certainty of protectiveness in the long-term. Moreover, because more of the groundwater is restored sooner, users see a smaller area of contamination over time and there is less chance of exposure to contaminated groundwater. The certainty of protectiveness in the long term is therefore greater with Alternative 4 and greatest with Alternative 5, in this regard.

Long Term Certainty of Protectiveness in Relation to Certainty of Long-Term Containment of the Benzene Plume

Alternative 2 relies on intrinsic biodegradation entirely to contain the benzene plume. Hydraulic extraction is not used under Alternative 2 to contain the benzene in the MBFC Sand. There is significant uncertainty as to whether intrinsic biodegradation will reliably contain the benzene plume in the MBFC Sand, once the pumping of the chlorobenzene plume starts. This is because pumping the chlorobenzene plume may pull on the benzene and may move it. In relying solely on intrinsic biodegradation, the risk of this movement is greater for a number of reasons discussed further below in this section in more detail. Therefore, once again in this respect, Alternative 2 provides the least certainty of long-term protectiveness.

Rather than relying on intrinsic biodegradation to contain the entire benzene plume, Alternatives 3, 4 and 5 alike use active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Because intrinsic biodegradation is merely a pre-existing condition in the soil, it cannot be controlled. However, hydraulic extraction and treatment can be designed and controlled directly to provide better, adjustable, and more reliable control of the possible movement of benzene in the MBFC Sand. The risks and implications of adverse benzene plume movement in the MBFC Sand (particularly movement into the Gage Aquifer) during the course of the remedial action, if the benzene plume is not actively contained, are substantial. Of particular concern are: (1) the higher permeability of the MBFC Sand compared to the UBF and MBFB Sand, (2) uncertainties related to the sources of benzene and preferential flow paths in the MBFC Sand, and (3) uncertainties in contaminant migration pathways within the LBF. These factors are due to a number of factors including uncertainties and limitations of the model, inability to effectively monitor the LBF, which separates the MBFC Sand from the Gage Aquifer, and the inability to effectively characterize small-scale contaminant migration pathways within the MBFC Sand and LBF. These and other issues related to benzene movement in the MBFC Sand are further discussed later in this section under EPA's Rationale for the Selected Alternative and Section 5 of the JGWFS.

The active hydraulic containment of the benzene plume in the MBFC Sand, found in Alternatives 3, 4, and 5 increases the certainty that the benzene plume will remain contained and will not move downward or sideways in response to hydraulic extraction (pumping) that is primarily targeted to containment and reduction of the chlorobenzene plume. Lack of reliable benzene containment could result in benzene migration outside the containment zone, which could

slow the progress in restoring groundwater outside the containment zone to drinking water standards in either the short or the long term. The JGWFS concluded that it is feasible to adequately contain the benzene plume in the MBFC Sand under Alternatives 3, 4 or 5 provided active hydraulic containment is used.

Alternatives 3, 4 and 5 provide more certainty with respect to long-term containment of the benzene plume than does Alternative 2, and hence, more certainty of long-term protectiveness in this regard.

12.2 Compliance with ARARs

As a matter of comparison, it is attaining ISGS levels (which embody in-situ groundwater chemical-specific ARARs) at all points in the groundwater outside the containment zone that is of concern. All other ARARs can be attained by any of the alternatives, with the exception of the No Action Alternative. The No-Action alternative would not attain ARARs.

As with protectiveness of human health and the environment, compliance with ARARs is considered as a threshold criterion [40 C.F.R. §300.430(f)(1)(i)(A)]. All of the alternatives, except for No Action, meet a threshold in that they have an reasonable potential to ultimately attain ISGS levels throughout the groundwater outside of the containment zone. Nonetheless, because of the long time frames associated with this remedial action, the alternatives differ widely in terms of the *certainty* of this over the long term. Therefore, for purposes of comparison, EPA also has discussed the alternatives in terms of degrees of this certainty.

Long-term certainty with respect to compliance with ARARs, in terms of attaining ISGS levels for all groundwater outside the containment zone, varies among the alternatives in exactly the same way and for the same reasons provided in the discussion of long-term certainty of *Protectiveness of Human Health and the Environment.* As discussed under Section 12.1, the shorter the cleanup time, the greater is the potential that the cleanup will ultimately attain ARARs in the long-term, as anticipated.

The National Contingency Plan (NCP), the regulations for Superfund, requires that remedial actions attain ARARs (in this case, drinking water standards in-situ) in a reasonable time frame. In the case of the Joint Site groundwater, EPA believes that an alternative should be considered more "reasonable" with respect to time frame if it restores a major portion of the aquifer to drinking water standards in a relatively more certain and short time frame, as compared to an alternative that restores very little of the aquifer until late in the long remedial action. As previously discussed, in this ROD EPA refers to this concept as early time performance of the alternative. Because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the

early period associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, there is greater certainty that the remedial objectives ultimately will be attained, particularly if the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool.

Also as with certainty of long-term protectiveness, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of the increase in pore volume flushing, provide greater certainty of attaining ARARs in the long term, than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide higher certainty that ARARs and remedial objectives will ultimately be achieved at all points in the plume outside the containment zone.

Overall, Alternative 2 provides the least certainty of long term compliance with ARARs, followed by Alternative 3, Alternative 4, and Alternative 5, in that order.

With respect to ultimately complying with ARARs (i.e.attaining ISGS levels at all points in the chlorobenzene plume outside the containment zone), Alternatives 2 and 3 are the poorest (and about the same relative to each other) with respect to certainty of attaining ARARs in the long term. Alternative 4 ranks above Alternatives 2 and 3, and Alternative 5 ranks above Alternative 4. The reasons for this are the same as those discussed above in Section 12.1 with respect to long term certainty of protectiveness with respect to attaining ISGS levels at all points in the chlorobenzene plume.

Alternatives which provide a lower certainty of containing the benzene plume also have a lower potential for attaining ISGS levels in the long term, because there is a greater chance that benzene contamination may move outside the containment zone, thwarting or lengthening the efforts to attain the concentration reductions necessary to attain ISGS levels there. With respect to this aspect, Alternatives 3, 4 and 5 are about the same, and superior to Alternative 2.

12.3 Long-Term Effectiveness

In the case of the Joint Site and the nature of the alternatives being considered, most of the arguments and factors related to long-term effectiveness parallel those related to certainty of protectiveness in the long-term, presented in Section 12.1. To some extent, these are repeated here for maximum clarity, although some of the discussion also differs.

In general, in dealing with extensive time frames, the longer the time required for a remedial alternative to meet remedial action objectives, the greater is the uncertainty that it will ultimately and fully meet those objectives at all. This is true because of the enormous degree of change that

can occur in human (e.g. social, demographic, resource use, etc.) and natural (e.g. groundwater gradients, flow, water levels) conditions over the course of such time periods. As an example, demographic and in turn, water use patterns and distributions may change. The demand for water and the nature of water use may shift with social, economic, or political factors. It is not possible to reliably predict the manner in and degree to which these factors will change over the course of a century or more. This point can be illustrated by considering a comparison of 1999 to 1899 with respect to population and resource use patterns, or considering the capability of a person in 1899 to predict such patterns as they exist today. The assumptions of the analyses of a feasibility study, both written and implicit, assume generally greater uncertainty as the intervening time frame becomes very long. Accordingly, in this case, EPA considered alternatives likely to have shorter cleanup times to be characterized by greater certainty of meeting long-term remedial action objectives, and hence greater long-term effectiveness.

Likewise, because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the early period that is associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool, and this also affords greater certainty that the remedial objectives ultimately will be attained. In contrast, alternatives with poor early time performance do most of the removal of contamination late, when uncertainties as to future conditions are larger, and at times which cannot be predicted accurately by the model.

An additional benefit of early time performance is that more of the restored groundwater resource is usable sooner. The larger the area of groundwater that has been restored to drinking water standards, and the sooner this area grows in size, the less opportunity there is over time for use to be made of water that would pose an unacceptable health risk. Early time performance therefore affords greater long-term effectiveness.

Finally, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of pore volume flushing, provide better long-term effectiveness than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide faster cleanup rates and a greater chance that all contamination throughout the plume will be addressed. Because contaminants will have been more evenly and completely flushed from the aquifer system, there is less chance that contaminant levels will rebound above ISGS levels and therefore greater chance in the long term that the remedy will remain permanent; hence, greater long-term effectiveness.

In light of the foregoing discussion, the No Action Alternative would not be effective or long-term effective. Alternative 2 has the least degree of certainty as to long-term protectiveness, followed by Alternative 3, Alternative 4, and Alternative 5, in that order. Issues related to long-

term effectiveness fall largely in two categories: (1) regarding reduction of the chlorobenzene plume outside the containment zone and the permanence of that action, and (2) regarding the certainty of long-term containment of the benzene plume, which lies entirely within the containment zone. Clearly, the greater the uncertainty that ISGS levels will ultimately be attained at all points in the chlorobenzene plume outside the containment zone, and the greater that this action is permanent, the greater the uncertainty in the long term protectiveness of the remedial action. Also, the greater the uncertainty that long-term containment of the benzene plume can be maintained, the greater is the chance that contaminants will escape the zone, thwarting efforts to clean groundwater outside the containment zone to ISGS levels. This would result in less long-term protectiveness.

It is noted that all alternatives (other than No Action) perform similarly with respect to long term containment of the portion of the *chlorobenzene* plume that lies within the containment zone.

Long-Term Effectiveness in Relation to Reduction of the Chlorobenzene Plume Outside the Containment Zone

Because of its relatively low total groundwater extraction rate and lower number of extraction wells, Alternative 2 would take the longest of all the alternatives to reach cleanup standards. This long time frame results in the least certainty that ISGS levels ultimately will be attained at all points in the plume. Alternative 2's performance (percent of plume removed) at 25 years is the poorest of the alternatives. In addition, in simulations of Alternative 2, the magnitude of the increase in pore volume flushing is very small, and the area where increased pore volume flushing occurs covers only about 50 percent of the chlorobenzene plume. This greatly decreases the certainty that ISGS levels would be attained at all points in the plume in the long term.. Alternative 2 has poor early time performance, again resulting in lower long-term effectiveness. Very little of the plume is removed during the time in which the model is an acceptable predictive tool. In addition, much more of the plume remains over the course of the remedial action, implying a larger contaminated area as time progresses, which in turn increases the chance that contaminated groundwater could be used over a long time frame. Alternative 3 has the same characteristics as Alternative 2 with respect to the characteristics just discussed.

Alternative 4, and to a greater extent, Alternative 5, because of their higher pumping rates, imply much shorter cleanup times. Performance in terms of percent of the plume removed at 25 years for Alternative 4 more than double that for Alternatives 2 and 3. Pore volume flushing rates are much higher, more consistent, and well-distributed than for Alternatives 2 and 3. The early-time performance of Alternative 4 is much better than Alternatives 2 and 3, and still better in Alternative 5. These aspects lend much greater certainty that ISGS levels will be attained throughout the plume outside the containment zone, end hence, greater long-term effectiveness. Because the plume is more efficiently and completely addressed by the remedial action under

Alternative 4 and 5, there is greater chance it will be permanent and therefore long-term effective. Moreover, because more of the groundwater is restored sooner, users see a smaller area of contamination over time and there is less chance of exposure to contaminated groundwater. The certainty of protectiveness in the long term is therefore greater with Alternative 4 and greatest with Alternative 5, in this regard. While the pore volume flushing of Alternative 5 is greater in magnitude than that of Alternative 4, both Alternative 4 and Alternative 5 provide complete and well-distributed coverage of the plume with respect to pore-volume flushing.

Long-Term Effectiveness in Relation to Certainty of Long-Term Containment of the Benzene Plume

Alternative 2 relies on intrinsic biodegradation entirely to contain the benzene plume. Hydraulic extraction is not used under Alternative 2 to contain the benzene in the MBFC Sand. There is significant uncertainty as to whether intrinsic biodegradation will reliably contain the benzene plume in the MBFC Sand, once the pumping of the chlorobenzene plume starts. This is because pumping the chlorobenzene plume may pull on the benzene and may move it. In relying solely on intrinsic biodegradation, the risk of this movement is greater for a number of reasons discussed further below in this section in more detail. Therefore, in this respect, Alternative 2 provides the least long-term protectiveness.

Rather than relying on intrinsic biodegradation to contain the entire benzene plume, Alternatives 3, 4 and 5 alike use active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Because intrinsic biodegradation is merely a pre-existing condition in the soil, it cannot be controlled. However, hydraulic extraction and treatment can be designed and controlled directly to provide better, adjustable, and more reliable control of the possible movement of benzene in the MBFC Sand. The risks and implications of adverse benzene plume movement in the MBFC Sand during the course of the remedial action, if the benzene plume is not actively contained, are substantial. Of particular concern are: (1) the higher permeability of the MBFC Sand compared to the UBF and MBFB Sand, (2) uncertainties related to the sources of benzene and preferential flow paths in the MBFC Sand, and (3) uncertainties in contaminant migration pathways within the LBF. These factors are due to a number of factors including uncertainties and limitations of the model, inability to effectively monitor the LBF, which separates the MBFC Sand from the Gage Aquifer, and the inability to effectively characterize small-scale contaminant migration pathways within the MBFC Sand and LBF. These and other issues related to benzene movement in the MBFC Sand are further discussed later in this section under EPA's Rationale for the Selected Alternative.

The active hydraulic containment of the benzene plume in the MBFC Sand, found in Alternatives 3, 4, and 5 increases the certainty that the benzene plume will remain contained and will not move downward or sideways in response to pumping primarily targeted to the

chlorobenzene plume. Lack of reliable benzene containment could result in benzene migration outside the containment zone, which could slow the progress in restoring groundwater outside the containment zone to drinking water standards in either the short or the long term. The JGWFS concluded that it is feasible to adequately contain the benzene plume in the MBFC Sand under Alternatives 3, 4 or 5 provided active hydraulic containment is used.

Alternatives 3, 4 and 5 provide more certainty with respect to long-term containment of the benzene plume than does Alternative 2, and hence, more long-term effectiveness in this regard.

12.4 Short-Term Effectiveness

Short-term effectiveness is generally attributed to the time during which the remedial action is ongoing but has not yet attained remedial action objectives. In the case of the Joint Site, this time period is greatly extended, and so this characterization of "short term" is actually long-term in its implications, and therefore is somewhat blended in nature with long-term effectiveness. Therefore, the same aspects noted for long-term effectiveness and with respect to certainty of long-term protectiveness are, in this sense, applicable to short-term effectiveness. Alternatives 2 and 3 provide relatively poor short-term effectiveness compared to Alternative 4, and in turn, Alternative 5, in relation to removing the chlorobenzene plume outside the containment zone during the course of the remedial action. Alternatives 3, 4, and 5 provide superior (and roughly equal) short-term effectiveness in terms of containing the benzene plume during the course of the remedial action.

It is noted that all alternatives, other than the No Action Alternative, the condition of containment of the containment zone is attained relatively quickly. In addition, all of the alternatives, other than the No Action Alternative, would arrest the outward migration of the chlorobenzene plume soon after implementation, although the certainty of containment is higher with for Alternatives 4, and 5, sequentially, than for Alternatives 2 and 3, which espouse the lower 350 gpm pump rate.

Alternatives which provide better early-time performance clearly provide short-term effectiveness; that is, over the course of the remedial action, a greater portion of the contamination is removed in a shorter time frame. The public also thereby realizes the benefit of clean groundwater over a larger area sooner under such alternatives. In this regard, Alternatives 2 and 3 provide the poorest short-term performance, Alternative 4 much better short-term performance, and Alternative 5 the greatest short-term performance.

The alternatives do not differ much in terms of short-term issues such as dangers that may exist to the public or workers during construction. There is little risk in this regard and standard, excepted engineering practices are available to mitigate such risks. Any of the alternatives could be implemented safely with respect to the public and to workers.

12.5 Reduction of Mobility, Toxicity and Volume of Contaminants Through Treatment

Alternative 1, No Action, would not reduce the mobility, toxicity, or volume of contaminants through treatment.

In all alternatives other than No Action, treatment is employed in the form of hydraulic extraction and treatment of contaminants, to the majority of the groundwater, as presented in Section 11 of this ROD. The efficiency and rate at which the alternatives reduce the mobility, toxicity, and volume of contaminants, differs widely by alternative, however.

Reduction in Volume of Contaminants In-Situ

Because the volume of the containment zone will remain fixed indefinitely, the primary factor for comparison with respect to volume in-situ is the ability of the alternative to reduce the volume of contaminated groundwater outside the containment zone. At the end of the remedial action, assuming all remedial objectives have been achieved, all of the alternatives other than No Action would result in the same reduction in the volume of contamination. However, the efficiency of the alternative in producing this reduction increases as: (1) the pump rate of the chlorobenzene plume outside the containment zone increases, (2) the early-time performance increases, and the pore volume flushing increases or becomes more completely- and evenly-distributed under an alternative. Alternatives with superior pore volume flushing and early time performance result in greater volume reduction, and a greater percentage of the groundwater resource becoming usable, sooner.

Alternatives 2 and 3 have the least pump rate, early time performance, and poorest poor volume flushing, and therefore are the least effective at reducing the volume of contamination over time, followed in order by Alternatives 4 and 5.

Reduction in Mobility of Contaminants In-Situ

All alternatives would be roughly equally effective in containing the DNAPL at the Montrose Chemical Site. Likewise, all alternatives would be effective at stopping the outward expansion of the chlorobenzene plume.

However, Alternatives 3, 4, and 5 are more effective at containing the benzene plume over the long term, and hence are more effective at limiting the mobility of the benzene plume. This is because these alternatives employ active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Alternative 2, in contrast, relies on intrinsic

biodegradation for this purpose. With the hydraulic effects of pumping the chlorobenzene plume, reliance on intrinsic biodegradation provides less control and less certainty of containing the benzene plume in the MBFC Sand, and hence less control on benzene mobility.

Reduction in Toxicity of Contaminants In-Situ

At the conclusion of the remedial action, if all remedial objectives have been met, the total reduction toxicity in-situ would be the same for all alternatives. However, as discussed, Alterative 2 and 3 are the poorest in terms of the efficiency with which they would reduce the toxicity of groundwater and the size of the area of groundwater which would pose a toxicity. Alternative 4 is superior to Alternatives 2 and 3 in this regard, and Alternative 5 is superior to Alternative 4.

Reduction in Toxicity, Mobility and Volume of Contaminants That Are Removed From Ground

In terms of mobility, toxicity, and volume of contaminants *that are removed from the ground*, all alternatives would be similar in that the volume of contaminants would be greatly reduced, from the great extent of contaminated groundwater to a treatment stream of much smaller volume. With any of the technologies or treatment trains used, the contaminant is ultimately destroyed (either off site, as in regeneration of activated carbon, or directly in the treatment process, such as in fluidized bed reactor). Hence, the mobility, toxicity, and volume of the contaminant is reduced ultimately to zero.

12.6 Implementability

Alternative 2 is the easiest to implement of the alternatives. This is in part because it implies the least number of extraction wells and injection wells, and the smallest injection rate. Injection presents more engineering challenges as the required injection rates increase, although these challenges typically do not make injection infeasible at any of the pumping rates considered for this remedial selection. Alternative 2 would imply the smallest number of properties which would have to be accessed for purposes of installing wells and water conveyance lines for the treatment system. Alternative 2 would require a smaller treatment system, which may provide some implementability benefits, but these are not expected to be highly significant.

Alternative 3 presents a few more implementability issues than does Alternative 2, because a separate system must be built and designed to implement the pumping and treatment of the MBFC Sand. Because the water quality near the benzene plume is different than in the chlorobenzene plume in terms of parameters such as total dissolved solids (TDS), the need to extract and

discharge treated water from this plume forces additional design and engineering considerations. However, Alternative 3 is still highly implementable.

Alternative 4 would be somewhat more difficult to implement compared to Alternative 3 due to the greater number of extraction wells and equipment required. Alternative 4 will require access to more properties to install wells and conveyance lines. The treatment systems would have to be larger and more sophisticated under Alternative 4 than under Alternative 3. Alternative 4 also would likely pose additional engineering challenges associated with aquifer injection. As aquifer injection rates increase, the potential for well plugging and fouling also tends to increase. However, at the 700 gpm pump rate considered, these issues should not be inordinately difficult nor insurmountable. Alternative 4 is highly implementable.

Alternative 5 is somewhat more difficult to implement than Alternative 4 due to the greater number of extraction wells and equipment required. Alternative 5 also would likely pose greater engineering challenges associated with the doubled rate of aquifer injection over Alternative 4. As aquifer injection rates increase, the potential for well plugging and fouling also tends to increase. Alternative 5 would require access to the greatest number of properties for installation of wells and conveyances. The treatment systems would have to be larger and more sophisticated under Alternative 5 than under Alternative 4. At the 1400 gpm pump rate considered, these issues would not be insurmountable, however, they become much more significant than with Alternative 4. Alternative 5 is still implementable.

12.7 Cost

The costs of the remedial alternatives were presented in Section 11. Tables 11-2 shows the capital, operation and maintenance (O&M), and out-year O&M costs on a 30-year present worth basis. While it is recognized that the remedial action will take considerably in excess of 30 years, because of the depreciation rate in the value of future dollars when measured in present worth, the costs associated with time beyond 30 years is negligible. Approximate calculations performed during the JGWFS revealed that, if 100 years were used instead of 30 years, the present worth cost estimates would be only approximately 10 percent higher. Likewise, if 200 years were used instead of 100 years, the present worth cost estimates would be only 1 percent higher.

It is useful to examine what each increase among the alternatives cost "buys," starting from the minimal Alternative 2, which addresses the chlorobenzene plume with hydraulic extraction at 350 gpm and uses intrinsic biodegradation to contain the entire benzene plume.

Alternative 3 has hybrid containment of the MBFC Sand benzene plume, whereas Alternative 2 does not. The cost of obtaining this is approximately $5 million.

Alternative 4 has hybrid containment of the benzene plume and also addresses the chlorobenzene plume with hydraulic extraction at 700 gpm, double the rate of Alternative 3. It removes double the volume of the contaminated chlorobenzene plume at 25 years as does Alternative 3. Alternative 4 costs $4 million more than alternative 3, and $9 million more than Alternative 2.

Alternative 5 has hybrid containment of the benzene plume and also addresses the chlorobenzene plume with hydraulic extraction at 1400 gpm, double the rate of Alternative 5 and approximately 4 times the rate of Alternative 3. It removes about 1.5 times the volume of the contaminated chlorobenzene plume at 25 years as does Alternative 4, and about 3 times as much as Alternative 3. Alternative 5 costs $10 million more than Alternative 4, $15 million more than Alternative 3, and $19 million more than Alternative 2.

From this, it can be seen that while Alternative 5 offers superior performance in all respects (long and short term effectiveness, early time performance, pore volume flushing), the doubling of the extraction rate from Alternative 4 to Alternative 5 does not provide a doubling of the effectiveness as it does from Alternative 3 to Alternative 4. At the same time, the cost difference between Alternative 4 and 5 is more than double the cost difference between Alternative 3 and 4.

12.8 State Acceptance

The State of California has provided EPA with its written concurrence and acceptance of the remedy selected by this ROD.

12.9 Community Acceptance

Having held a public comment period and hearing and responded to all pertinent comments as required by law, EPA believes that the degree of community acceptance of the selected alternative is high.

12.10 Rationale for EPA's Selected Alternative

After consideration of the comments received during the public comment period and based on the administrative record, EPA is selecting ***Alternative 4,*** referred to in the JGWFS as *Benzene Hybrid Containment / Chlorobenzene Plume Reduction 2 (700 gpm).*

As discussed in earlier sections, the groundwater, should it ever be used, would present an unacceptable risk. Because the groundwater continues to move, new portions of the resource can become impacted by contamination in the future. The NAPL itself serves as a principal threat which continues to contaminate groundwater. The regulations direct EPA to restore this groundwater to drinking water standards in a reasonable time frame where it is practicable to do so (i.e. these standards are ARARs where not waived). The alternative EPA is selecting to remedy the groundwater contamination at the Joint Site eliminates the dissolved phase contamination outside the containment zone, meets ARARs where practicable, contains the principal threat, and safely contains contamination with a significant degree of certainty where it is not practicable to meet ARARs. ***Alternative 4*** represents an appropriate balance between performance and practicability, and also between long-term certainty of effectiveness and cost.

This section discusses EPA's rationale for this selection. It is noted that the rationale for the aspects of the proposed TI Waiver Zone were provided in Section 10. Also, the rationale for the approach to the TCE plume was provided in Section 11.

In April 1997, EPA's National Remedy Review Board (NRRB) reviewed EPA's intended proposed remedial action for the Joint Site groundwater and supported it.

All of the alternatives considered, except for Alternative 1, No Action, imply the presence of a hydraulic containment zone for NAPL for an indefinite duration, perhaps centuries. Such time frames are far beyond our present capabilities to model or anticipate. While not losing sight of cost effectiveness, EPA has placed a premium of value on actions that will reduce the long-term uncertainty in the remedy. It is difficult to assess whether, for instance, EPA or the responsible parties will exist in 500 years to ensure the remedy remains effective and protective. It is true that presently it is not possible to clean all groundwater at the Joint Site to drinking water standards. While this must be accepted, it is for the same reason appropriate to deal with long-term uncertainties conservatively. In many ways which are discussed in the JGWFS, the duration of this remedial action is directly related to the uncertainty as to its long-term success. Therefore, when more of the plume is removed early, less of the plume remains subject to large long-term uncertainties. This means it is appropriate to value the alternatives which provide early time performance and take less time to implement. Likewise, alternatives with more certainty of

maintaining reliable containment of the NAPL zones are favored by EPA over those providing less certainty, because the containment must be in place and effective for such a long time.

Alternative 4 (as Alternatives 2, 3 and 5) hydraulically isolates the NAPL so that the largest reasonable portion of the contaminated groundwater can be restored to drinking water standards and to limit the potential for human exposure to contaminated groundwater. The selected action also arrests the further lateral and vertical movement of all plumes.

While addressing NAPL isolation (both by hydraulic containment and by intrinsic biodegradation), Alternative 4 (as well as 2, 3, and 5) also mitigates drawdowns and reduction in interstitial pore pressures near the NAPL, factors which could otherwise induce NAPL to migrate downward. EPA has soundly and consistently considered the issues of adverse migration and plume interactions (NAPL movement and the inducement of movement of one plume due to actions focused on another plume). The potential for such factors has been addressed and modeled in detail by the feasibility study. EPA's evaluation and consideration of potential adverse migration and plume interactions is manifest in the very design of the alternatives (e.g. the pump rates considered), is a principal factor in the selection among the alternatives, and plays a prominent role among the ROD requirements in Section 13 of this ROD. Alternative 4 strikes a good balance between (1) reducing the size of the plume outside the containment zone at an acceptable rate, with significant early time performance and substantial and well-distributed pore volume flushing, on the one hand, and (2) avoiding movements of contaminants and other situations which might make the contamination worse or cause net delays in the cleanup effort.

Finally, as discussed, EPA assumes for the purposes of this analysis that NAPL is recovered (removed) from, and/or immobilized at, these sites to the extent determined appropriate by a separate remedial action selection process. This NAPL removal has the potential to limit the degree to which the NAPL can move, increasing the long-term certainty of effectiveness of this proposed groundwater remedy.

Rationale With Respect To The Chlorobenzene Plume

As discussed, with respect to the chlorobenzene plume, Alternative 4 provides greater and better-distributed pore volume flushing, stronger early time performance, and a shorter overall cleanup time as compared to Alternatives 2 and 3. This means overall uncertainties of long-term remedy performance and of meeting the remedial action objectives are lower, including ultimate attainment of drinking water standards. While the performance of Alternative 4 is markedly superior to that of Alternatives 2 and 3, the cost of Alternative 4 is only $4 million more than the cost of Alternative 3. EPA therefore favors Alternative 4 over Alternatives 2 and 3 for the reasons discussed at the beginning of this section.

EPA does not believe that the low rate of cleanup provided by Alternatives 2 and 3 provides for too much uncertainty that remedial objectives, including ARARs, will ultimately be achieved and that the remedial action will be fully protective of human health for the long term. The poor and sporadic pore volume flushing adds to this conclusion. Also, because these alternatives provide poor early-time performance with respect to the chlorobenzene plume, it would take much longer under these alternatives to realize any environmental gains (in terms of usability of the aquifer resource) and it is much less certain that the cleanup time frame can be considered "reasonable."

Based on the findings in the JGWFS, there is no reason to accept the low degree of aggressiveness and cleanup rate posed by Alternatives 2 and 3, as it is feasible to design the remedy at the higher pump rates posed by Alternative 4 without incurring significant additional risk of adverse contaminant migration or plume interaction. It is noted that this ROD requires that the remedial action be designed in such a way that such adverse migration is limited and that containment of the containment zone is accomplished. Hence, the wellfields used in the JGWFS can be adjusted in the remedial design as necessary to accomplish this objective. At the same time, as discussed in Section 11.1, this ROD requires that limiting of adverse migration take place within the context of meeting all other remedial action objectives and requirements in this ROD, rather than take preeminence over these.

The performance of Alternative 5 is clearly superior to that of Alternative 4. In fact, the model predicts that almost all of the chlorobenzene plume is removed in 25 years. Alternative 5 provides higher, but roughly as-well-distributed pore volume flushing rates compared to Alternative 4. However, Alternative 5 costs $10 million more than Alternative 4, and the relative increase in performance is less than the increase of Alternative 4 over Alternative 3. In addition, Alternative 5 poses some issues with implementability which would likely be of lesser prominence than with Alternative 4. While EPA does not believe these issues would be insurmountable, it is possible that the true costs of Alternative 5 could be higher in dealing with such issues (e.g. plugging of re-injection wells at higher injection rates).

In this ROD, EPA has specified other performance criteria in addition to the approximate pumping rate to be used with respect to reduction of the chlorobenzene plume outside the containment zone. While the pumping rate was the primary basis for distinguishing among wellfields and alternatives in the JGWFS, it was chosen because of its ability to produce an expected result. Hence, this ROD specifies not only that the remedial action primarily targeting the chlorobenzene plume be constructed and operated at approximately 700 gpm, but that it be designed to remove 33 percent of the plume in 15 years, 66 percent of the plume in 25 years, and 99 percent of the plume in 50 years, as measured by a refined computer model during the remedial design phase of the remedial action, and that progress toward these targets be monitored during the course of the remedial action. It is recognized that the model will not predict actual cleanup times, but progress can be tracked on a relative basis. The ROD also requires that a basic

minimum average pore volume flushing rate be achieved by the remedial system. These requirements are provided in Section 13 of this ROD.

Rationale With Respect To The Benzene Plume

Alternative 4 (as do Alternatives 3 and 5) contains hybrid containment for the benzene plume, which means that biodegradation is relied upon for the UBF and the MBFB Sand, but that the benzene in the MBFC Sand is contained by active hydraulic extraction. This is an appropriate balance between cost and long-term certainty of containing the benzene plume.

The UBF and the MBFB Sand are fine-grained units in which the groundwater flow velocities are very low. While they are classified as drinking water units, their relatively low ambient water quality, low water-producing potential, and small aquifer thickness make them less-likely candidates for actual groundwater use. There is strong evidence for intrinsic biodegradation and a relatively stable benzene plume in these units under natural conditions. The risk of a failure of intrinsic biodegradation to contain the benzene plume in these units is relatively low. It is appropriate to rely on intrinsic biodegradation in this case, so long as contingent active hydraulic extraction is also required in the event that intrinsic biodegradation fails to keep the benzene plume contained. This ROD applies contingencies as part of the selected remedial action for the benzene plume.

However, the considerations for the benzene plume in the MBFC Sand are different. EPA's evaluation led to the conclusion that the risks of relying solely on intrinsic biodegradation for the benzene plume in the MBFC Sand are not acceptable if a sufficient cleanup rate is to be achieved for the chlorobenzene plume. Such risks include not only the potential for benzene movement but the implications if benzene does move. Using hydraulic extraction and injection to contain the benzene plume in the MBFC Sand, assuming such containment is properly designed and optimized, is safer and more reliable.

EPA's conclusion accounts for several other factors other than the modeling results themselves, including:

- The MBFC Sand and Gage Aquifers are thicker, more permeable, and deeper, than the UBF and MBFB Sand, and are characterized by higher groundwater flow velocities, and therefore deviations between simulations and reality are more critical (contamination is closer to water actually being used for drinking, has more production potential, and the water has the potential to move more quickly);
- The Gage Aquifer is the first significantly-water bearing unit in which the benzene plume does not occur; at the same time, it is much more likely to be used as a drinking water

source than is the MBFC Sand (noting that the State of California designates all units at the Joint Site as having potential potable beneficial use);

- Vertical migration into the Gage Aquifer is of paramount concern and protection of the Gage Aquifer critical;

- The LBF separating the MBFC Sand and the Gage Aquifer is very fine-grained and cannot be effectively monitored;

- The sources of benzene in the benzene plume of the MBFC Sand are not well understood; this was discussed earlier in this ROD in Section 7, "Summary of Site Characteristics;"

- The movements of contaminants from the MBFC Sand through the LBF into the Gage Aquifer are likely to be heavily influenced by localized phenomena such as preferential flow paths;

- The model used in the JGWFS is not appropriate for modeling vertical contaminant *transport* from the MBFC Sand through the LBF into the Gage Aquifer (See Section 7 and the Response Summary of this ROD for more discussion on this issue);

- Additional modeling optimization is unlikely to overcome the uncertainties posed by the above conditions of the hydrostratigraphic units and modeling limitations;

- The vertical transport of benzene into the Gage Aquifer can only be monitored with wells placed in the Gage Aquifer; however, if benzene arrives there, it is "too late" in that benzene has already loaded the LBF and contamination of the Gage has occurred.

The modeling simulations resulted in small movements of benzene toward the chlorobenzene plume under the various pumping rates for chlorobenzene which were simulated. This simulated movement was small, however it is precisely in the area least desirable for benzene movement. Benzene at this location would be entering the chlorobenzene plume and possibly moving downward into the Gage Aquifer.

EPA stresses that the modeling used in the JGWFS is unreliable for predicting the movement of benzene from the MBFC Sand into the Gage Aquifer. This is discussed earlier in Section 7, "Summary of Site Characteristics" as well as in detail in the Response Summary. The fact that this limitation exists does not in any way impugn the model's validity. All models have limitations. Models should be used only for the purposes which lie within their identified limitations, and should not be extended to purposes beyond.

In this case, the model is highly useful for a wide variety of JGWFS uses, but not in particular for predicting the movement of benzene from the MBFC Sand into the Gage Aquifer. Therefore, while the model predicts no vertical migration into the Gage Aquifer, EPA does not consider this result reliable, and the risks of benzene movement in response to pumping primarily targeting the chlorobenzene plume are greater than the model would imply. EPA believes that the modeling uncertainties and the higher risk factors associated with the MBFC Sand combine to make reliance on intrinsic biodegradation to contain the benzene plume for the MBFC Sand risky. It is for this reason that EPA screened out alternatives which relied on intrinsic biodegradation for the MBFC Sand at the higher 700 and 1400 gpm pump rates for chlorobenzene. For the same reasons, EPA believes that Alternative 2 presents a risk which is not warranted given the relatively small additional cost of active hydraulic containment of the MBFC Sand and therefore prefers Alternatives 3, 4 and 5 to Alternative 2 with respect to this issue.

Alternative 4 contains active hydraulic containment of the MBFC Sand, which can be designed and manipulated to provide the maximum hydraulic control and therefore the maximum certainty in the long term that the benzene plume will remain contained. It is noted that it is much easier and far less costly to establish containment by hydraulic extraction in the MBFC Sand, than in the fine-grained MBFB Sand or the UBF.

Rationale for Remedial Actions for pCBSA

Section 7, "Summary of Site Characteristics" outlined the distribution of the chemical para-chlorobenzene sulfonic acid (pCBSA) and Section 8, "Summary of Groundwater-Related Risks" discussed its toxicological status. pCBSA is a byproduct of the manufacture of DDT, created when sulfuric acid sulfonates monochlorobenzene, one of the raw materials for making DDT. The compound is highly water soluble which reduces its retardation coefficient and has resulted in its moving a greater distance in groundwater than chlorobenzene (See earlier sections). There are no promulgated standards or reliable toxicological reference values for pCBSA. While some studies have been completed with respect to pCBSA, no chronic (long-term) studies have been performed and the studies are insufficient to allow EPA to set toxicological reference values or establish health-based standards. No studies of pCBSA are planned or underway at this time.

The JGWFS has shown that treatment of pCBSA will not occur coincidentally with the treatment of the other groundwater contaminants, if the most cost-effective technology for the other contaminants is employed. An explanation follows. The JGWFS did show that concentrations of pCBSA in the extracted groundwater effluent stream could be dramatically reduced by the treatment train which includes Fluidized Bed Reactor (FBR) plus liquid-phase carbon adsorption polishing. Tests indicate that FBR would be effective at destroying 95-99 percent of the pCBSA. This treatment train is one of three that this ROD selects as available in remedial design. However, in the absence of a promulgated health-based standard for pCBSA, and in turn, an

ISGS under this ROD, there is not an established concentration to which pCBSA concentrations in-situ (concentration remaining in the ground) must be reduced that can numerically drive the analysis of the technology used. Therefore, the-situ concentration of pCBSA will be reduced only if this reduction occurs coincidentally with the treatment used to achieve ISGS levels in groundwater for all other contaminants at the Joint Site.

While FBR plus carbon adsorption polishing is available and effective at treating the other contaminants as well as pCBSA, it was determined that liquid phase carbon adsorption acting alone, rather than FBR, would be the most cost-effective treatment train for attaining the health-based standards of all other contaminants. Unfortunately, liquid phase carbon adsorption performs rather poorly at removing pCBSA from groundwater. While this technology does remove some pCBSA, impractically large amounts of carbon are needed to achieve significant removal over extended periods of time.

The JGWFS evaluated the additional cost of using FBR plus carbon adsorption to address the Joint Site groundwater in the case where significant active treatment of pCBSA is required. As stated earlier, no health-based value was available for pCBSA to assume as a target cleanup concentration, so 99 percent removal of pCBSA was assumed for this analysis. This is the demonstrated removal efficiency/capability of FBR. The additional cost of using FBR, with all other parameters and assumptions constant, was on the order of $5 million.

This figure, however, represents only the additional cost of treating the pCBSA that lies *within* the chlorobenzene plume. The alternatives in the JGWFS assumed capture and mass/volume reduction for the chlorobenzene plume, and treatment and discharge of the resulting extracted groundwater. But the pCBSA distribution is *larger* than the chlorobenzene plume in all directions. Hence, as the JGWFS notes, the costs of capturing and reducing the much larger pCBSA distribution (over what would be a longer time period) and treating all of the water using FBR, would be far greater than this $5 million. To obtain an accurate estimate of the full additional cost of addressing all pCBSA ***in-situ***, a wide-ranging expansion of the feasibility study and its modeling would have been necessary. While this was not performed, the JGWFS reasonably concludes that the costs for such an endeavor could be in the many tens of millions of dollars and could double the cost of the remedial action.

If carbon adsorption acting alone is used, the pCBSA will, for the most part, not be removed from the extracted groundwater, which will then be re-injected into the aquifers. The result of this aquifer injection is that in-situ concentrations of pCBSA will decrease and become more evenly-distributed overall due to dilution. However, the pCBSA will cover a somewhat larger area of groundwater in the process. Modeling suggests that after 50 years under Alternative 4, concentrations of pCBSA will average 1000-5000 ppb over the entire distribution of pCBSA.

Having found no *in-situ* standards which might apply to pCBSA, EPA evaluated whether there were other requirements that might apply to *injection* of pCBSA into the aquifer. As discussed earlier in this ROD, aquifer injection is a necessary component of this remedy in order to achieve the hydraulic control necessary to prevent adverse migration of contaminants and NAPL, and to limit the effect of the remedial action on contamination sites outside the Joint Site. While the State of California did not identify any such injection standards to EPA, the State did request that EPA consider a non-promulgated To-Be-Considered criterion (TBC) of 25,000 ppb as a limit on the concentration at which pCBSA could be injected into the aquifer. Upon consideration of this TBC, EPA has decided to make it a ROD standard for this remedial action.

In April 1997, EPA's National Remedy Review Board (NRRB) reviewed EPA's intended proposed remedial action for the Joint Site groundwater and supported it. While the NRRB had no direct recommendations, they did issue a statement that they assume that EPA can seek to address costs associated with pCBSA by various elements of the remedial design. EPA will address this in the remedial design phase. It was noted, also, that the NRRB was in accordance with EPA's proposal not to actively capture or treat the pCBSA plume at this time.

In light of the above analysis and information, EPA has selected a set of remedial actions for pCBSA separately from the other groundwater contaminants at the Joint Site. Based on the extent of knowledge at this time, *these remedial actions are protective of human health and the environment.* These actions do not require that the area of groundwater affected by pCBSA be captured or reduced in volume. We note that no one is presently drinking water contaminated by pCBSA, though as with the other contaminants at the Joint Site, the potential for future use of the groundwater resource, either from the existing contaminant distribution of after that distribution has spread to a larger area, is possible. Future toxicological studies may reveal data or results which would allow for setting a health-based standard for pCBSA, in which case the continued protectiveness of the remedial action with respect to pCBSA would have to be reassessed by EPA. While EPA does not have direct control over which chemicals are studied, EPA is informing those with influence in this regard about the pCBSA at the Joint Site so that they can prioritize it properly among all other chemicals awaiting study.

As discussed in Section 11, the following remedial actions are selected by this ROD for pCBSA:

- The concentration at which pCBSA is re-injected into the ground shall be limited to 25,000 ppb. The State of California holds that 25,000 µg/l can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

- The full downgradient extent of pCBSA contamination shall be determined and the movement of pCBSA shall be routinely monitored.
- Sampling at potentially susceptible public production wells shall include analyses for pCBSA.
- Well surveys shall be routinely updated to identify any new wells which may lie within the pCBSA distribution.
- At the Superfund 5-year reviews required by law, EPA will re-evaluate whether additional toxicological studies have been performed for pCBSA, assess the extent of the pCBSA plume and make determinations as to whether the remedy remains protective with respect to pCBSA

Finalizing of the Del Amo Waste Pits ROD

On September 5, 1997, EPA issued a ROD for the Del Amo Waste pits. This ROD specified that the remedial (cleanup) standards for soils under the Waste Pits were to be considered interim pending a decision by EPA on the groundwater. This was because it was not known at that time what the joint groundwater ROD would select as groundwater standards under the Waste Pits. This ROD establishes a TI waiver zone which includes the groundwater under the Waste Pits. This means that the water under the Waste Pits will not be restored to drinking water standards by the remedial action. EPA believes, therefore, that the currently-existing soil standards in the Del Amo Waste Pits ROD will be sufficient to prevent significant additional contamination from entering the groundwater at that location, and will allow for groundwater remedial action objectives to be satisfied.

The interim soil standards in the Waste Pits ROD were not based on cleaning soil under the Waste Pits so as to achieve drinking water standards in groundwater. Rather, the goal of the interim standards was to ensure that any additional contamination coming from the Waste Pits in the future would be small relative to the existing contamination already in the groundwater. In effect, this was to control the Waste Pits as a major source of additional contamination.

While the remedy selected by this ROD places the Waste Pits in a TI waiver zone, EPA believes it is still prudent to limit the amount of additional contamination that can be added by the Waste Pits to the groundwater system. The TI waiver waives the requirement to clean groundwater to drinking water standards, but it does not preclude reasonable and appropriate source control measures to ensure that large quantities of additional contamination, NAPL or otherwise, do not arrive in the groundwater. The interim standards were set based on this goal. Accordingly, EPA

makes final the soil standards for the Del Amo Waste Pits as they currently exist in the Waste Pits ROD.

13. Specification of the Selected Remedial Action: Standards, Requirements, and Specifications

The remedial action implemented as selected by this ROD shall meet the standards, requirements, specifications, and provisions (hereafter, "provisions" unless otherwise noted) contained in this section. The remedial action shall be designed with the express purpose and intention of meeting these provisions. Discretion and latitude shall be preserved in designing the remedy within the range of possible designs meeting the requirements of this section. There are provisions which are established in other sections of this ROD. The provisions in this section apply *in addition* to, and not in lieu of, provisions which appear before or after this section of the ROD.

As previously established, this ROD selects differing remedial actions and objectives to apply to various areas of the groundwater at the Joint Site that are defined in this ROD. Some of the provisions vary depending on the hydrostratigraphic unit that is the subject of the provision. The reasons for this were established and discussed previously.

As discussed in Section 7.2 of this ROD, the term "plume" has a specialized use in this ROD. The formal definition of each plume is provided in this Section. "Plume" does not always refer to the entire distribution of a contaminant in groundwater, but rather refers to a particular portion of the distribution which espouses a certain set of physical characteristics and will respond to one set of remedial actions and objectives (See Section 7). The term "plume" applies to all hydrostratigraphic units within which a referenced plume occurs unless otherwise stated.

The following hydrostratigraphic units are referenced and addressed by this ROD:
Upper Bellflower, Middle Bellflower B Sand (MBFB Sand), Middle Bellflower C Sand (MBFC Sand), Lower Bellflower Aquitard, Gage Aquifer, Gage-Lynwood Aquitard, Lynwood Aquifer, Lynwood-Silverado Aquitard, and Silverado Aquifer.

For convenience and clarity, the provisions in this ROD are numbered and are segregated into subsections with headings.

PROVISIONS

1 Provisions Apply to the Joint Site.

All provisions below apply to the Joint Site. The term *Joint Site* was defined in Section 6 of this ROD. It is noted that the Joint Site includes any physical space within the groundwater to which contaminants may move, either vertically or laterally, during the course of the remedial action.

2 In-Situ Groundwater Standards (ISGS).

The particular in-situ concentration for each contaminant which this ROD requires be attained in groundwater at the conclusion of the remedial action is referred to by this ROD as the ***in-situ groundwater standard***, or ***ISGS.*** This ROD establishes the ISGS for the Joint Site groundwater as the lower of the State or federal Maximum Contaminant Level (MCL) as established under the Safe Drinking Water Act. In cases of contaminants where MCLs do not exist, the ISGS shall be EPA's Tap Water Preliminary Remediation Goals, which are based on the lower of a 10^{-6} cancer risk or a non-cancer hazard index of unity for residential exposure assumptions. The ISGS levels were shown in Table 9-1, and discussed in Section 9 of this ROD.

3 Definition of Plumes.

This remedy assigns differing provisions, remedial actions, and objectives to various areas of groundwater. Each such area is referred to as a "plume" by this ROD. Section 7.2 of this ROD, "Convention for Dividing the Contamination into Plumes," provides the basis for dividing the overall distribution of contamination in this fashion. Unless otherwise noted, the term *plume* as used in this section shall be defined under this provision. Provisions not specifying applicability to a specific plume shall apply to all groundwater at the Joint Site, unless otherwise noted in the provision.

3.01 **Chlorobenzene Plume.** The *chlorobenzene plume* shall include the entire distribution of chlorobenzene in groundwater at the Joint Site, *and* all other contaminants that are commingled with the chlorobenzene. Benzene, trichloroethylene (TCE), perchloroethylene (PCE), and a variety of other contaminants are present within the chlorobenzene plume. The chlorobenzene plume is present in the MBFB Sand (the UBF is unsaturated in the area where the chlorobenzene plume occurs), the MBFC Sand, the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer, based on data collected in the remedial investigation.

3.02 **Benzene plume.** The *benzene plume* shall include the portion of the distribution of benzene in groundwater at the Joint Site *that is not commingled* with chlorobenzene. Put another way, the benzene plume is that benzene within the Joint Site that lies outside the chlorobenzene plume. The benzene plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, based on data collected in the remedial investigation. Benzene that is commingled with chlorobenzene is not considered to be part of the benzene plume, but is instead part of the chlorobenzene plume. The benzene plume includes ethyl benzene and naphthalene, among other contaminants.

3.03 **TCE.** The term *TCE,* unless otherwise noted, when used in reference to a plume or contaminant distribution in groundwater, shall represent a series of chlorinated aliphatic VOCs, including but not limited to TCE, PCE, dichloroethylene (DCE), trichloroethane (TCA), and any isomers of these compounds in groundwater at the Joint Site. The term does not include chlorobenzene or polychlorinated benzenes.

3.04 **TCE Plume.** The *TCE plume* shall include the portions of the distributions of any such contaminants in groundwater at the Joint Site *that are not commingled* with the chlorobenzene plume. The TCE plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, based on data collected during the remedial investigation. The TCE plume in the UBF and MBFB Sand is commingled with the benzene plume. The downgradient extent of the TCE plume in these units does not exceed the extent of the benzene plume. The TCE plume in the MBFC Sand lies *under* the benzene plume in the MBFB Sand and north of the benzene plume in the MBFC Sand (See Figures 7-2 and 7-4). TCE (chlorinated solvent) contamination outside the chlorobenzene plume which may exist in the Gage Aquifer is not considered to be part of the TCE plume and will be addressed separately. TCE that is commingled with chlorobenzene is not considered part of the TCE plume but is part of the chlorobenzene plume.

4 Additional Data Acquisition

4.01 **TCE Plume.** The current downgradient extent of the TCE plume is bracketed by several downgradient wells that have non-detect values for TCE concentration. This, combined with its location relative to the benzene NAPL, allows for this remedy to address the TCE (See Section 11). However, additional data is necessary in order to complete remedial design for the remedy. It is noted that portions of the remedial design could be completed without this data. Sufficient monitoring wells shall be installed and sampled in the UBF, the MBFB Sand, MBFC Sand, and the Gage Aquifer to:

(1) identify and characterize the sources of chlorinated solvents in the TCE plume, including their location and the possible presence of NAPL associated with these sources, and

(2) define the distribution sufficiently to allow for a remedial design of the remedial action selected by this ROD.

4.02 **Benzene Plume in the MBFC Sand.** In the remedial investigation, monitoring wells were never installed in the MBFC Sand under or near-downgradient to the high concentrations of benzene which were eventually discovered in the MBFB Sand near what is today called the "WRC building" in the eastern portion of the benzene contaminant distribution. These wells shall be installed and sampled under this remedy during the remedial design phase. The number of wells, their location and construction design shall be established in the monitoring plan for the remedial action and shall be subject to the approval of EPA.

4.03 **Well Survey.** The well survey for the Joint Site shall be updated. Wells existing within one-half mile of the area of groundwater contamination at the Joint Site (including pCBSA contamination), shall be identified and mapped. The well survey shall be a document of public record on file with EPA Region IX. Well surveys shall be further updated as described in later subsections, below.

4.04 **pCBSA.** The extent of the contaminant para-chlorobenzene sulfonic acid, or pCBSA, downgradient and side-gradient from the Montrose property shall be determined by installation and sampling of additional wells. The extent shall be determined to a non-detectable concentration as determined and approved by EPA in its Monitoring Plan for the Joint Site remedy, which is required by this ROD. Production wells within 1 mile of the terminus (downgradient extent) of the pCBSA distribution and within one-half mile cross-gradient as determined by the midline of the pCBSA distribution shall be tested for pCBSA and the results shall be made available to the public. Additional monitoring requirements after the initial sampling are addressed below under Monitoring. Provisions for finding pCBSA in production wells are provided below under "Ensuring Protection of Human Health During the Course of the Remedial Action."

5 Containment Zone

5.01 Dissolved phase contamination in a specific zone of groundwater, defined in the provisions which follow, shall be contained and isolated indefinitely such that the contamination cannot escape the zone. This zone is referred to by this ROD as the ***containment zone***[1]. There shall be a single containment zone for the Joint Site. The basis for the size and configuration of the containment zone (and TI waiver zone) was discussed in Section 10, "Technical Impracticability Waiver and Containment Zone" in this ROD.

5.02 The containment zone shall surround the NAPL in a region of groundwater, defined in this ROD, to which remedial actions selected by this ROD shall be applied to prevent the escape of dissolved-phase contaminants. The containment zone shall be implemented such that dissolved phase contaminants within the containment zone, and contaminants dissolving from NAPL within the containment zone, shall be prevented from escaping the containment zone and from entering the groundwater outside the containment zone. The NAPL, and all contaminants within the containment zone, shall thereby be *isolated* from the groundwater outside the containment zone.

5.03 Dissolved phase contamination within the containment zone shall be considered contained when it is reliably prevented from moving outside the containment zone by the remedial actions selected by this ROD, in accordance with the specifications, requirements, and standards established by this ROD.

5.04 **Geographical Definition.** The technical basis for the size and shape of the containment zone was discussed in Section 10. Although its shape, size and extent were determined by EPA using a scientific basis, the containment zone is established by this ROD *geographically*. That is, the extent of the containment zone is not conditional but represents a fixed volume in space, defined by the boundaries herein described.

5.05 **Specification of Lateral Extent of the Containment Zone.** The lateral extent of the containment zone in the various hydrostratigraphic units shall be as depicted in Figure 10-1. The lateral extent of the containment zone differs by hydrostratigraphic unit, and is based on the various arguments provided in Section 10 of this ROD.

5.06 **Lateral Extent of Containment Zone in the Lower Bellflower Aquitard (LBF).** The containment zone shall have the same lateral shape, size and extent in the LBF as in the

[1]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

MBFC Sand, *within the chlorobenzene plume*. The containment zone shall have no extent in the LBF outside the chlorobenzene plume.

5.07 **Depth of the Containment Zone Within the Chlorobenzene Plume.** The containment zone shall extend through the Gage Aquifer and all shallower hydrostratigraphic units *within the chlorobenzene plume*. The containment zone shall not include any extent in the Gage-Lynwood Aquitard or the Lynwood Aquifer.

5.08 **Depth of the Containment Zone Within the Benzene and TCE Plumes.** The containment zone shall extend through the MBFC Sand and all shallower hydrostratigraphic units *in the TCE and benzene plumes*. The containment zone shall exclude the Lower Bellflower Aquitard, the Gage Aquifer, and the Lynwood Aquifer in these plumes.

6 Technical impracticability ARAR waiver

6.01 Specific applicable or relevant and appropriate requirements (ARARs), which EPA has determined would otherwise apply to this remedy, shall be waived due to technical impracticability as provided by CERCLA at 42 U.S.C. §9621(d)(4)(C) and 40 C.F.R.-300.430(f)(1)(ii)(C)(3). This waiver shall apply solely and specifically to a zone of groundwater referred to in this ROD as the ***TI waiver zone***. Because the TI waiver is being applied exclusively to the containment zone defined in Provision 5 above, the terms *TI waiver zone* and *containment zone* are congruent and refer to the same physical space with respect to this remedy for the Joint Site. This waiver shall not apply to any other groundwater within the Joint Site. The basis for this waiver is discussed earlier in this ROD in Section 10 and is provided in detail as Appendix E of the JGWFS.

6.02 The ARARs to be waived based on technical impracticability for the TI waiver zone are identified in Appendix A of this ROD. The primary ARARs being waived under the TI waiver, where it applies, is the requirement that concentrations of contaminants in groundwater be reduced to at or below the MCL (promulgated drinking water standards), as discussed in Section 9 of this ROD.

6.03 The TI waiver is necessary because it will not be practicable to restore groundwater within the TI waiver zone to MCLs within a reasonable time frame as required by the National Contingency Plan (NCP). This is discussed in Section 10 of this ROD and in Appendix E of the JGWFS. This is due to the presence of NAPL under the specific site conditions it occurs at the Joint Site.

6.04 The TI waiver shall apply to all contaminants within the TI waiver zone, regardless of whether a particular contaminant provided the original basis for the waiver. This was discussed in the JGWFS and in Section 10 of this ROD.

7 Containment of the Overall Contaminant Distribution.

In addition to meeting all other provisions in this ROD (including but not limited to requirements to reduce the volume of the chlorobenzene plume that has concentrations exceeding the ISGSs for any contaminant), the remedy shall achieve containment of the overall contaminant distribution in that the physical size of the union of the chlorobenzene, benzene, and TCE plumes shall not increase from such point in time as the remedial action is initiated. As a corollary, the lateral extent of the overall contaminant distribution in each of the contaminated hydrostratigraphic units shall not increase, and the vertical extent of the overall contaminant distribution shall not increase. The chemical pCBSA shall not be subject to this provision for reasons discussed in Section 12 of this ROD.

8 Containment Within the Containment Zone.

8.01 Dissolved phase contaminants within the containment zone shall remain contained to the zone and shall not escape the zone. This condition shall be preserved indefinitely by this remedial action. Contaminants shall not leave the containment zone either laterally or vertically at any point along the three-dimensional boundary of the containment zone.

8.02 Means by Which Containment Shall Be Achieved Within the Containment Zone

8.02.01 **Chlorobenzene Plume.** Containment of the chlorobenzene plume within the containment zone shall be affected by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by aquifer injection of the treated water through one or more injection wells. Provisions for aquifer injection under the "Plume Reduction" section of provisions below shall apply to this injection. Hydraulic extraction and aquifer injection of water shall be optimized in remedial design to ensure that containment is achieved and that the other provisions in this ROD are attained.

8.02.02 **Benzene Plume in the UBF and MBFB Sand.** Containment of the benzene plume within the containment zone shall be effected by reliance on monitored intrinsic biodegradation. It is recognized that other natural processes may aid in the containment of the benzene in these units. However, it is the process of intrinsic biodegradation which makes the reliance on natural processes for these units feasible from a remedial standpoint. The continued stability and containment

of the benzene plume in the UBF and MBFB Sand shall be monitored as specified below, and if transgressions of containment occur, contingencies shall be implemented, as specified below.

8.02.03 **Benzene Plume in the MBFC Sand.** Containment of the benzene plume within the containment zone in the MBFC Sand shall be effected by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by discharge of the treated water. Discharge provisions are given below. Such hydraulic extraction shall independently establish the capture of the benzene plume within the MBFB Sand.

Other actions such as the adjustment of the locations and flow rates of injection and extraction wells being used for other elements of the remedy may be employed during the optimization of the remedial design to assist the hydraulic extraction in achieving containment of the benzene plume in the MBFC Sand. However, these actions shall not be taken *in lieu* of hydraulic extraction required under this provision.

It is recognized that intrinsic biodegradation is also occurring to the benzene in the MBFC Sand, and that this naturally-occurring process will, to a significant extent, assist the active processes to be implemented by this provision in containing the benzene plume in the MBFC Sand. However, by virtue of the analyses put forth in the JGWFS and earlier in this ROD, this ROD is explicitly selecting *active* hydraulic containment, as the remedial action for the benzene plume in the MBFC Sand. The optimization of aquifer injection being performed for the chlorobenzene plume shall also be performed during remedial design to limit the potential for transgressions of benzene containment.

8.02.04 **TCE Plume.** Containment of the TCE in the NAPL containment zone shall be partially accomplished by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by discharge of the treated water. Specifically, this groundwater extraction shall be undertaken at low pump rates close to the TCE sources which are indicated by existing data to lie within the containment zone but upgradient of the benzene NAPL. Additional data on TCE sources shall be collected as provided above prior to executing this response action. This action shall occur at low pump rates sufficient solely to:

1. Contain the immediate TCE source locations, and
2. Provide a control on the amount of mass leaving the sources and entering the greater TCE plume.

This action will not actively contain the entire TCE plume. Containment of the remainder of the TCE plume shall be accomplished by the contingencies provided below. Such contingencies shall be activated if the extent of the TCE plume currently within the containment zone/TI waiver zone comes to exceed the containment zone/TI waiver zone.

During remedial design, the overall remedial system shall be designed to take advantage of injection and other hydraulic controls so as to limit the movement of the TCE in response to hydraulic extraction being undertaken under this remedy for the chlorobenzene and benzene plumes.

8.02.05 **Optimization.** In the remedial design phase of the remedy, the remedial wellfield and relative pump rates among wells in the wellfield shall be optimized so as to limit the lateral and vertical movement of TCE. Such optimization in design shall also be performed so as to maximize the certainty of containment of contamination within the containment zone. However, such optimization shall not counter or override meeting any of the other requirements and provisions in this ROD.

8.03 Monitoring and Monitoring Plan for Containment

A monitoring plan shall be developed and approved by EPA for matters related to the containment of the dissolved phase contaminants surrounding NAPL in the containment zone. At a minimum, this plan shall provide for sampling of monitoring wells sufficient to meet the objectives stated below in this provision and any additional goals identified in the approved monitoring plan. Additional monitoring wells shall be installed, as necessary, to achieve the objectives of the monitoring plan. Continual monitoring shall be conducted as part of this remedy in accordance with the EPA-approved Monitoring Plan for as long as the containment zone is in effect as part of the remedy.

8.03.01 **Minimum Objectives of the Monitoring Plan with Respect to Containment Zone.** The monitoring plan shall provide for, at a minimum:

- Confirmation that contaminants within the containment zone have not left the zone;
- Data sufficient to reliably evaluate compliance with any and all requirements, standards, and provisions in this ROD;

- Reliable evaluation of the lateral and vertical movements of all contaminants of concern within the containment zone;

- Reliable evaluation of the lateral and vertical movements of benzene, TCE, and chlorobenzene in response to hydraulic extraction in the overall system;

- Evaluation of the effectiveness of partial containment of the TCE plume by hydraulic extraction and the degree of movement of TCE toward the boundary of the containment zone;

- Data sufficient to determine groundwater levels, hydraulic gradients, reliable groundwater elevation contour maps, effects of any local pumping both on and off the Joint Site, and groundwater flow velocities within all of the affected hydrostratigraphic units at the Joint Site;

- Verification and evaluation of the zones of capture of extraction wells and the radii of influence of extraction and injection wells;

- Reliable evaluation of gradient control measures;

- Data sufficient to measure and verify drawdowns in the immediate vicinity of the NAPL sources due to pumping;

- Evaluation of efforts to optimize the wellfields and pump rates associated with hydraulic extraction and aquifer injection of treated water so as to provide the greatest certainty of long-term containment, and reduce the potential for plume interactions and adverse migration of NAPL and dissolved contaminants;

- Reliable concentrations of contaminants in treatment system influent and effluent, and treatment streams so as to assess the effectiveness and performance of the treatment system; and

- Additional aquifer tests including but not limited to aquifer stress, pumping, and recovery tests, such as to provide estimates of local or general parameters such as hydraulic conductivity, storativity, specific yield, as determined necessary in the monitoring plan.

8.03.02 **Monitoring Wells.**. The approved Monitoring Plan shall establish the monitoring objectives, which shall include but not be limited to the objectives specified in this

ROD, and shall list the monitoring wells serving each objective. During the remedial design phase of the remedy, the wells necessary to meet each objective shall be identified, taking into account the location, construction, and other circumstances associated with all existing wells. Should EPA determine that additional wells are necessary to meet the objectives in the approved Monitoring Plan, such wells shall be installed and sampled.

8.03.03 **Monitoring Wells in Regard to Containment.** Sufficient monitoring wells shall be placed around the periphery of the containment zone in each hydrostratigraphic unit where the containment zone occurs to ensure that failures of the remedial actions to contain contaminants to the containment zone (transgressions of containment) will be promptly detected. Sufficient numbers of monitoring wells also shall be placed in the hydrostratigraphic units below the containment zone to determine that contaminants have not migrated vertically out of the containment zone. Monitoring well construction and locations shall be approved by EPA as part of the remedial design and additional wells may be added as determined necessary by EPA during the remedial action and operation and maintenance (O&M) phase. This may include wells in either aquifers or aquitards.

8.03.04 **Monitoring frequency.** The frequency of monitoring for all wells in the monitoring network shall be specified and justified in the approved Monitoring Plan, in accordance with the ability to attain the stated monitoring objectives. Any changes to the monitoring frequency for one or more wells shall be approved by EPA by means of an amendment to the Monitoring Plan which states the justification for the changes.

8.03.05 **Monitoring Analytes, Sampling Protocols, and Methods**. EPA shall approve one or more field sampling plans (FSPs) and Quality Assurance Project Plans (QAPPs) which shall establish the sampling protocols, analytical protocols, quality assurance and quality control parameters and protocols, data quality objectives, and sample rotation. Such plans shall be in accordance with all applicable EPA regulations, policy, and guidance. The FSP(s) and QAPP(s) may be incorporated into or attached to the Monitoring Plan as approved by EPA. Modifications to the sampling and analytical protocols shall be accompanied by the appropriate modification to the FSP or QAPP.

8.03.06 **Direct Monitoring of Intrinsic Biodegradation**. The continued reliability of intrinsic biodegradation to contain the benzene plume in the UBF and the MBFB Sand shall be verified by actual periodic confirmation of the biological activity in the benzene plume. The degree, frequency, types of testing, etc. of such

monitoring shall be established in the approved Monitoring Plan. The frequency may be modified as approved by EPA in amendments to the Monitoring Plan. The monitoring shall include, but shall not be limited to, one or more of the following:

- Analysis of samples from monitoring wells along a transects running from the center to the outside of the benzene plume for dissolved oxygen, nitrate, sulfate, and methane, to be followed by evaluation of the degree of biodegradation in the context of electron donor-acceptor pairs and benzene biodegradation mechanisms.

- Analysis of groundwater or saturated zone soil samples to establish biodegrader counts.

- Analysis of groundwater samples for biodegradation interim by-products.

- Systematic measurements of benzene intrinsic biodegradation rate.

The frequencies of any such tests may vary according to the approved Monitoring Plan.

8.04 Contingent Actions

In the event that EPA determines that the actions selected by this ROD have not contained contaminants within the containment zone contingent actions shall be taken to (1) restore the condition of containment, (2) meet all remedial action objectives and ROD standards, and (3) meet ARARs where not waived, including attaining ISGS levels in groundwater. Contamination which leaves the containment zone also leaves the TI waiver zone; such contamination is not subject to the TI waiver and is subject to cleanup to ISGS levels as is all contamination outside the TI waiver zone.

It is not possible in advance to specify in detail the design particulars of all contingent actions, because the number of possible types of transgressions is large. Therefore, contingent actions are specified on a conceptual basis. "Transgressions of Containment" in this subsection refers to the condition upon which EPA has determined that contaminants within the containment zone have not been contained as required by this ROD. "Rectifying" transgressions of containment in this subsection refers to restoring the condition of containment after the transgression, meeting all remedial action objectives and ROD standards, and meeting all ARARs after a transgression.

8.04.01 **Chlorobenzene Plume.** Under this ROD, containment of the containment zone in the chlorobenzene plume is accomplished by active hydraulic extraction. Transgressions of containment in the chlorobenzene plume shall be rectified by adjustments to this active hydraulic means, which shall include (1) adjusting the pumping rates of one or more extraction and injection wells, and/or (2) installation of additional extraction and/or injection wells.

8.04.02 **Benzene Plume in the MBFC Sand.** Under this ROD, containment of the benzene plume in the MBFC Sand is accomplished by active hydraulic extraction. Transgressions of containment in the benzene plume in the MBFC Sand shall be rectified by adjustments to this active hydraulic means, which shall include (1) changing the pumping rates of one or more extraction and injection wells, and/or (2) installation of additional extraction and/or injection wells.

8.04.03 **Benzene Plume in the UBF and MBFC Sand.** Under this ROD, containment of the benzene plume in these units is contained by reliance on monitored intrinsic biodegradation with a contingency for active hydraulic extraction. Transgressions of containment shall be rectified by active hydraulic means, which shall include (1) changing the pumping rates of one or more existing extraction and injection wells, and/or the installation of extraction wells and initiation of hydraulic extraction specifically to rectify the transgression.

8.04.04 **Limitations on Contingent Actions.** Unless there is no other option, activation of a contingent action:

- Shall not reduce the rate of cleanup of the chlorobenzene plume;
- Shall not reduce the certainty of the containment of chlorobenzene, benzene, or TCE within the containment zone;
- Shall be effective in rectifying the transgression in a timely manner.

8.04.05 **Rectifying the Transgression.** Contingent actions shall reduce the concentrations of contaminants in the groundwater affected by the transgression to the levels which existed prior to the transgression. If no detectable contamination existed at the point of the transgression outside the containment zone, then the contingent action shall reduce the concentrations at that point to below detectable levels. Contingent actions shall also reduce contaminant migrations within the containment zone such that the transgression will not continue.

9 Plume Reduction

9.01 Basic Requirement.

The volume of groundwater within the Joint Site that is *outside* the containment zone at concentrations that exceed ISGS levels for any contaminant as identified by this ROD shall be reduced to zero in a reasonable time frame. This process shall be referred to as "plume reduction." The concentrations of contaminants in all groundwater at the Joint Site outside the containment zone shall be reduced to concentrations below the ISGS for each contaminant present in groundwater. ISGS values are specified on a contaminant-specific basis.

9.02 Means of Plume Reduction and Requirement of Aquifer Injection for the Chlorobenzene Plume

Plume reduction shall be achieved by hydraulic extraction and treatment. This shall include a series of hydraulic extraction wells from which water will be pumped to a treatment unit or units for treatment, followed by treated water discharge. For the chlorobenzene plume that is outside the containment zone, aquifer injection shall be implemented as the treated water discharge option. Feasibility Studies have shown that aquifer injection is necessary in conjunction with the plume reduction of the chlorobenzene plume to achieve the gradient control necessary to (1) reduce the potential for induction of movement of NAPL, and (2) limit the possibility of adverse migration of contaminants both within and from outside the Joint Site, within the context of meeting all remedial action objectives of this ROD. Accordingly, aquifer injection of treated water shall be applied in such a way as to achieve these goals and in accordance with the provisions in this Section of the ROD. Aquifer injection shall be accomplished by a series of aquifer injection wells.

9.03 Performance Criteria for Plume Reduction of the Chlorobenzene Plume

The following performance criteria with respect to plume reduction of the chlorobenzene plume shall be met by this remedial action. The reduction of the concentration of contaminants in groundwater outside the containment zone to levels below in-situ groundwater standards shall occur in a reasonable time frame.

9.03.01 **All of the Provisions Shall Be Met.** No one of these provisions is merely a focus for attaining one or more of the other provisions. All provisions shall be met, even if doing so will result in one or more provisions not only being met, but exceeded. As an example, provisions below require a certain pump rate, a certain pore volume flushing rate, and a certain minimum overall rate of reduction of the plume. These provisions independently apply. Thus, even if the minimum rate of reduction of the plume would be exceeded by attaining the pump rate and pore volume flushing rate specified, these shall still be attained.

9.03.02 **Pump Rate.** Hydraulic extraction shall be occur at a combined pump rate of approximately 700 gpm, mostly in the MBFC Sand and the Gage Aquifer. This ROD recognizes that pilot testing, design adjustments, and optimization modeling will occur during the remedial design phase, and the intent of this provision is not to overly limit design. However, it is intended that hydraulic extraction take place at a rate as close as feasible to the 700 gpm rate shown effective in the feasibility study for Alternative 4, and that this rate be departed from only if shown necessary and if approved by EPA.

9.03.03 **Hydrostratigraphic Units Affected by Hydraulic Extraction.** The MBFC Sand, the Gage Aquifer, and the Lynwood Aquifer shall be subject to direct hydraulic extraction. The MBFB Sand, the LBF, and the Gage-Lynwood Aquitard shall be subject to hydraulic extraction only to the extent shown necessary in remedial design to meet all other provisions, standards, goals and requirements of this ROD.

9.03.04 **Plume Reduction Rate Design and Early Time Performance.** The remedy shall be designed such that, at a minimum, the rate of plume reduction achieves the following performance criteria ***when modeled*** by a remedial design model approved by EPA (Provision 11):

The following performance standards shall apply:

- 33% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 15 years;
- 66% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 25 years;

- 99% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 50 years.

The simulations of the rate of plume reduction to evaluate compliance with this reduction rate at the time of design shall be based on the modeling done during the remedial design effort. The model and its construction shall be approved by EPA and run using the specific well fields and pump rates in the design. It is recognized that actual cleanup times may be longer than those simulated by the model and that the model may not be able to correct for such deviations. Where practical, however, the design shall minimize the influence of those factors which lead to such modeling deviations.

9.03.05 **Early Time Performance Principle**. The total time frames envisioned as part of this remedy are quite long (50 to100 years), by necessity. In order to ensure that the remedy achieves the standards of this ROD in a reasonable time frame, it is an explicit objective of this remedy that it achieve significant reductions in the volume of contaminated groundwater outside the containment zone in the early time period (first 25 years). It is typically the last 25 percent of contamination which takes the longest to remove; hence, if a remedial system is properly designed, a large percentage of the volume of contaminated groundwater can be removed early in the implementation of the remedial action even if the total time to reach compliance with all objectives is long. The design of this remedy shall not be compromised in such a way that little cleanup is achieved in the first 25 years.

9.03.06 **Pore Volume Flushing Rates.** Flushing is the process by which contaminants are pushed from the ground during hydraulic extraction. The remedial action shall be designed in such a way that (1) in the MBFC Sand and Lynwood Aquifer, *at least* 1 net pore volume of water per year; and (2) in the Gage Aquifer, *at least* 0.5 net pore volumes of water per year; be exchanged throughout the area of groundwater remaining that has concentrations of any contaminant in excess of ISGS levels. This minimum annual net pore volume flushing rate may not be sufficient to meet the other provisions in this ROD and the pore volume flushing rate may need to be adjusted upward either at specific locations or all locations within the plume during the remedial design or remedial action phases of this remedial action.

9.03.07 **Well Replacement.** As the volume of water that is contaminated above ISGS concentrations shrinks during plume reduction, it may occur that the downgradient portion of the plume is eliminated before the portion of the plume located more proximally to the NAPL sources. The most downgradient hydraulic extraction

wells may then come to be located beyond the toe of the plume. If this occurs, extraction from these wells will be discontinued. These wells shall be replaced with new hydraulic extraction wells inside the remaining plume, if EPA determines this is possible without compromising any other objectives of the remedial action as required by this ROD. The pump rate and locations for the replaced wells shall be established in adjustments to the remedial design, and shall be subject to EPA approval. In this manner, the capacity of the remedial system will be utilized to its maximum capacity and cleanup rates will be maintained.

9.04 Monitoring and Monitoring Plan for Plume Reduction

9.04.01 **Monitoring and Monitoring Plan**. A monitoring plan shall be developed and approved by EPA for matters related to plume reduction. This may be done in the same physical plan as the monitoring plan for the containment zone. At a minimum, this plan shall provide for sampling of monitoring wells sufficient to meet the objectives stated below in this provision and any additional goals identified in the approved monitoring plan. Additional monitoring wells shall be installed, as necessary, to achieve the objectives of the monitoring plan. Continual monitoring shall be conducted as part of this remedy in accordance with the EPA-approved Monitoring Plan until such time as the remedial action for plume reduction is determined complete by EPA.

9.04.02 **Minimum Objectives of the Monitoring Plan with Respect to Plume Reduction.** The monitoring plan shall provide for, at a minimum:

- Data sufficient to reliably evaluate compliance with any and all requirements, standards, and provisions in this ROD;
- Reliable estimates of the rate that the volume of contaminated groundwater with concentrations of contaminants above ISGS levels is being reduced;
- Reliable estimates of the rate that mass of contaminants is being removed from the groundwater;
- Reliable estimates of the pore volume flushing rates throughout the remaining plume that is contaminated with concentrations of contaminants in excess of ISGS levels;
- Reliable evaluation of the lateral and vertical movements of all contaminants of concern within the plume reduction zone;

- Reliable evaluation of the lateral and vertical movements of benzene, TCE, and chlorobenzene in response to hydraulic extraction in all hydrostratigraphic units;

- Data sufficient to determine groundwater levels, hydraulic gradients, reliable groundwater elevation contour maps, effects of any local pumping both on and off the Joint Site, drawdowns, and groundwater flow velocities within all of the affected hydrostratigraphic units at the Joint Site;

- Verification and evaluation of the zones of capture of extraction wells and the radii of influence of extraction and injection wells;

- Reliable evaluation of the effectiveness of vertical and horizontal gradient control measures;

- Data sufficient to measure and verify drawdowns in the immediate vicinity of the NAPL sources due to pumping;

- Evaluation of efforts to optimize the wellfields and pump rates associated with hydraulic extraction and aquifer injection so as to provide the greatest certainty of long-term containment, and reduce the potential for plume interactions and adverse migration of NAPL and dissolved contaminants;

- Reliable concentrations of contaminants in treatment system influent and effluent, and treatment streams so as to assess the effectiveness and performance of the treatment system; and

- Additional aquifer tests including but not limited to aquifer stress, pumping, and recovery tests, such as to provide estimates of local or general parameters such as hydraulic conductivity, storativity, specific yield, as determined necessary in the monitoring plan.

9.04.03 **Monitoring Wells..** The approved Monitoring Plan shall establish the monitoring objectives, which shall include but not be limited to the objectives specified in this ROD, and shall list the monitoring wells serving each objective. During the remedial design phase of the remedy, the wells necessary to meet each objective shall be identified, taking into account the location, construction, and other circumstances associated with all existing wells. Should EPA determine that

additional wells are necessary to meet the objectives in the approved Monitoring Plan, such wells shall be installed and sampled.

9.04.04 **Monitoring Frequency.** The frequency of monitoring for all wells in the monitoring network shall be specified and justified in the approved Monitoring Plan, in accordance with the ability to attain the stated monitoring objectives. Any changes to the monitoring frequency for one or more wells shall be approved by EPA by means of an amendment to the Monitoring Plan which states the justification for the changes.

9.04.05 **Monitoring analytes, sampling protocols, and methods.** EPA shall approve one or more field sampling plans (FSPs) and Quality Assurance Project Plans (QAPPs) which shall establish the sampling protocols, analytical protocols, quality assurance and quality control parameters and protocols, data quality objectives, and sample rotation. Such plans shall be in accordance with all applicable EPA regulations, policy, and guidance. The FSP(s) and QAPP(s) may be incorporated into or attached to the Monitoring Plan as approved by EPA. Modifications to the sampling and analytical protocols shall be accompanied by the appropriate modification to the FSP or QAPP.

10 Limiting Adverse Migration of Contaminants Within Context of Remedial Objectives

10.01 **Limit Adverse Migration of NAPL.** This remedial action shall limit the *induction*[2] of NAPL migration by limiting hydraulic drawdowns and changes in vertical gradients in the physical space where the NAPL occurs. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL or dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. In the event this occurs, the remedial design shall be adjusted to reverse and contain the adverse migration. Limiting adverse migration of NAPL shall not take preeminence over the other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone. Further discussion of this matter occurs in Section 11.1, including the definition of adverse migration.

[2]The migration of NAPL that occurs naturally is not eliminated by this remedial action; this action does limit inducing further such movement, however. See Section 4 of this ROD.

10.02 **Limit Adverse Migration of Dissolved Phase Contamination.** The concept of adverse migration of contaminants was discussed in Section 11.1 of this ROD. The remedial action shall be designed to limit adverse migration of dissolved phase contaminants within the context of meeting all other provisions of this ROD. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of dissolved contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. In the event this occurs, the remedial design shall be adjusted to reverse and contain the adverse migration. Limiting adverse migration of contaminants shall not take preeminence over the other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone. The objective to limit adverse migration of dissolved phase contamination shall not supercede or take preeminence over the other performance provisions of this ROD. Further discussion on this matter appears in Section 11.1, including the definition of adverse migration. At a minimum, adverse migration of dissolved phase contaminants in the following forms shall be limited as part of the design of this remedial action:

- Adverse movement of chlorobenzene to areas not presently affected by chlorobenzene;
- Adverse movement of chlorobenzene, or TCE in the chlorobenzene plume, from shallower to deeper hydrostratigraphic units, including but not limited to (1) from the MBFC Sand into the LBF and the Gage Aquifer, (2) from the Gage Aquifer to Gage-Lynwood Aquitard and into the Lynwood Aquifer;
- Adverse movement of benzene from the MBFB Sand into the MBFC Sand in the benzene plume;
- Adverse movement of benzene in the benzene plume from the MBFC Sand into the LBF and the Gage Aquifer;
- Adverse movement of benzene currently in the chlorobenzene plume into lower hydrostratigraphic units, especially from the MBFC Sand into the LBF and the Gage Aquifer;

- Adverse movement of benzene currently in the benzene plume in the MBFC Sand toward the interface of the benzene and chlorobenzene plumes, and subsequently into the chlorobenzene plume;

- Adverse movement of the TCE (and related chlorinated solvents) in the MBFB Sand and MBFC Sand of the benzene plume laterally toward to south or west and hence closer to the containment zone (TI waiver zone) boundary;

- Adverse movement of TCE (and related chlorinated solvents) from the MBFB Sand of the TCE plume into the MBFC Sand;

- Adverse movement of TCE (and related chlorinated solvents) from the MBFC Sand of the TCE plume into the LBF and into the Gage Aquifer;

- Adverse movement of TCE (and related chlorinated solvents) from sources off the Joint Site to the north and to the west toward the Joint Site.

10.03 **Vertical Gradient Control Wells.** Where necessary to offset the vertical gradient imposed by pumping in a lower hydrostratigraphic unit, hydraulic extraction shall take place in the hydrostratigraphic unit overlying that unit, in order to prevent or minimize the movement of contaminants from the upper to the lower unit in response to the induced vertical gradient. As an example, even though pumping is not required in the MBFB Sand of the benzene plume to contain the benzene plume in that unit because intrinsic biodegradation is being relied upon for that purpose, some limited pumping may have to take place in the MBFB Sand in order to offset vertical gradients induced by pumping in the MBFC Sand. The need for and placement of such wells shall be determined in remedial design.

10.04 **Non-Interference.** The remedial design shall be optimized to the extent possible to minimize potential interference from sources of contamination not presently being addressed as part of the Joint Site. The design objective to limit such interference shall not supercede or take preeminence over the other performance provisions of this ROD. Rather, limiting the potential for such interference shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

While it has not been determined necessary at the time this ROD is issued, it may be found, either during remedial design or in the course of the remedial action, that additional remedial actions are necessary at the locations of such off-site sources in order to prevent

interference from those sources. As determined necessary by EPA, EPA may either (1) issue administrative non-interference orders (see Provision 15, below) to parties associated with such sources requiring that such they cease and/or desist from interfering with the remedy, or (2) amend this ROD to select specific remedial actions for such sources as part of the Joint Site.

11 Flow and Transport Modeling and Optimization of the Remedial Action

11.01 **Computer Model.** A computer-based groundwater flow and contaminant transport model shall be developed, as necessary, and used during the remedial design, and also used as needed during the remedial action and O&M phases of the remedy for the purposes of (1) assisting in evaluating the potential for adverse migration of NAPL and dissolved phase contaminants, (2) assisting in verifying the compliance with performance requirements, (3) *assisting* in optimizing the remedial design to maximize the effectiveness of the remedial action, and (4) any other purposes determined necessary during the remedial design effort. The computer model developed during the feasibility study shall be utilized as appropriate in developing the remedial design model. EPA shall review and approve the model used and all aspects of the development and site-specific construction of the model prior to its use. The model shall be used only as appropriate, given its limitations and uncertainties, to complete the remedial design.

11.02 **Optimization during Remedial Design and During Remedial Implementation.** The wellfield used in the remedial action, including the location of hydraulic extraction wells and aquifer injection wells, and the relative pumping rates among the wells and hydrostratigraphic units, shall be determined and optimized in the remedial design phase. Optimization shall be performed as determined necessary by EPA, in the remedial design. Optimization shall also be performed as determined necessary by EPA during the remedial action, whenever (1) extraction or injection wells are being added or removed, (2) pump rates are being adjusted, (3) adjustments are necessary to rectify a transgression of the containment zone, or (4) other times as required by EPA.

The computer-based groundwater flow and contaminant transport model discussed in Provision 11.01 shall not be the exclusive means of optimizing the remedial design or remedial action. Rather, pilot testing, and adjustments and hydraulic response tests using actual hydraulic extraction and injection systems, shall be employed in conjunction with modeling simulations to optimize and adjust the remedial action. (See EPA Response ✍344 in the Response Summary; Response to Del Amo Respondents for further discussion).

Optimization is a process by which the remedial design and action is adjusted to attain maximum effectiveness with respect to meeting the requirements of this ROD; optimization does not represent an evaluation of *whether* to meet such requirements.

The remedial design and action shall be optimized:

- For the efficiency and rate of removal of contaminants;
- For pore volume flushing;
- For the rate of reduction of the volume of groundwater with concentrations of contaminants in excess of ISGSs;
- For early time performance (See Sections 11 and 12 of this ROD);
- For meeting all performance provisions above with respect to reduction of the plume outside the containment zone;
- For the certainty of containment of contaminants in the containment zone and the overall chlorobenzene plume; and
- To limit the potential for adverse migration of contaminants and NAPL during the course of the remedial action;

while meeting all provisions and objectives of this ROD.

12 Provisions for para-Chlorobenzene Sulfonic Acid (pCBSA)

The following provisions shall apply to pCBSA. A detailed discussion of this contaminant is provided in several sections earlier in this ROD. There are no promulgated health-based standards and there are insufficient toxicological data to determine provisional standards for this contaminant. pCBSA is not a hazardous substance under CERCLA, but is a "pollutant or contaminant" (See CERCLA Section 101). pCBSA shall be subject to the monitoring plan requirements 9.04.01, 9.04.03, 9.04.05 and 9.04.06, as well as all provisions in this subsection. pCBSA shall not be subject to the other provisions in this Section. The following provisions shall apply to pCBSA:

12.01 **pCBSA Injection Limits**. No water containing pCBSA at concentrations exceeding 25,000 micrograms per liter (μg/L) shall be injected into the ground in the course of this remedial action. Micrograms per liter is the equivalent of parts per billion (ppb) for water.

The State of California holds that 25,000 μg/L can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

pCBSA shall not be injected into the Gage-Lynwood Aquitard, the Lynwood Aquifer, nor any point at lower elevation than these hydrostratigraphic units during the course of this remedial action.

12.02 **Additional Monitoring Requirements for pCBSA**. Provisions given above for additional data acquisition require that the toe and sides of the pCBSA plume be identified during the remedial design phase. The following additional monitoring shall be performed for pCBSA as part of this remedial action.

- Continued monitoring of the downgradient extent of the pCBSA distribution in all hydrostratigraphic units in which it occurs so that EPA can evaluate its proximity to production wells;

- Continued monitoring of the side-gradient extent of the pCBSA distribution in all hydrostratigraphic units where it occurs so that EPA can evaluate the effect of aquifer injection of treated water which still contains some pCBSA.

- Periodic measurements of pCBSA concentrations within the core of the pCBSA distribution to assess the effects of redistribution and dilution that occur as a result of aquifer injection of treated water which still contains some pCBSA.

- Monitoring of water from the production wells in nearest proximity to the downgradient toe of the pCBSA distribution as identified in the approved monitoring plan.

13 Treatment for Extracted Groundwater

The following provides the requirements for treating water removed as part of the hydraulic extraction systems described in this remedial action. Groundwater shall be treated according to ARARs identified in Appendix A of this ROD prior to discharge. This ROD does not limit the treatment of extracted groundwater to a single technology. This ROD selects several technologies which are hereby considered "available" to the remedial design. ARARs applicable to each of these technologies have been identified in Appendix A.

Provision 13.01 and 13.02 pertain to primary treatment technologies which are designed to address the primary contaminants at the Joint Site. Provision 13.03 pertains to ancillary technologies, which reduce concentrations of ambient substances in groundwater to allow treated water to meet discharge standards, when the primary technologies are insufficient to do so. Provision 13.04 pertains to supplementary technologies, which can be used in modular fashion as necessary to assist in meeting remedial goals.

Primary, ancillary, and supplemental treatment technologies, and treatment trains, were discussed at the end of Section 11.4 of the Decision Summary of this ROD.

13.01 **Primary Treatment Technologies for the Chlorobenzene and Benzene Plumes.** The following primary technologies shall be considered available for the remedial design for treatment of the chlorobenzene and benzene plumes:

- Adsorption including liquid phase granular activated carbon (LGAC);
- Air Stripping plus LGAC polishing;
- Circulating Fluidized Bed Reactor (FBR) plus LGAC polishing

The JGWFS demonstrated that, based on data from the Remedial Investigation Reports, adsorption operating alone would be the most cost-effective primary technology for treatment of extracted groundwater. Air Stripping and FBR, if utilized, requires an LGAC polishing step to be effective in attaining all discharge requirements, as well as to ensure efficient progress in attaining ISGS levels in-situ for the Joint Site.

13.02 **Primary Treatment Technologies for the TCE Plume.** The following primary technologies shall be considered available for the remedial design for treatment of the water from the partial containment of the TCE plume (near the TCE sources near the upgradient end of the former Del Amo plant):

- Adsorption including liquid phase granular activated carbon (LGAC);
- Air Stripping plus LGAC polishing.

The JGWFS demonstrated that, based on data from the Remedial Investigation Reports, adsorption operating alone would be the most cost-effective primary technology for treatment of extracted groundwater. Air Stripping, if utilized, requires an LGAC polishing step to be effective in attaining all discharge requirements, as well as to ensure efficient progress in attaining ISGS levels in-situ for the Joint Site.

13.03 **Ancillary Technologies.** Ancillary technologies are those required to treat extracted groundwater to reduce the concentration of naturally-occurring species in the water to

meet regulatory standards and engineering requirements associated with the discharge of the water. Such technologies shall be applied, when necessary, in addition to the primary treatment technologies. It is anticipated by the JGWFS, based on water quality data, that the ancillary technologies may be necessary. For example, naturally occurring copper must be reduced to meet surface water discharge standards if the wellfields assumed in the JGWFS are utilized. These ancillary technologies shall be utilized, to the extent that EPA determines them necessary during the remedial design phase. Ancillary technologies are listed in Table 11-3, in Section 11 of the Decision Summary of this ROD.

13.04 **Treatment Trains.** The JGWFS considered a set of treatment trains that were identified in Section 11.4 of this ROD, as listed in Table 11-4 of the Decision Summary of this ROD and in the JGWFS. However, treatment trains composed of any combination of available primary and ancillary technologies, as specified above, may be designed and utilized for this remedial action.

13.05 **Supplemental Technologies.** Liquid Gravity Separation, and Advanced Oxidation Processes, may be used, in supplemental fashion, as part of the remedial action as determined necessary in remedial design. It is not intended that these technologies wholesale replace those selected as available for the remedial action as specified above; however, they may be added or used at appropriate times or in appropriate places as necessary. This was discussed in Section 11 of the Decision Summary of this ROD.

13.06 **Number of Treatment Plants.** The JGWFS evaluated the situation where there were three treatment plants, one for each plume. Provided all provisions and ARARs specified in this ROD are met, however, the number of treatment plants is not specified by this ROD and shall be determined in remedial design. All ARARs identified in this ROD, and all independently applicable requirements, if any, which pertain to the discharge of treated water shall be attained by the treatment plants prior to discharge. The number of treatment plants shall be determined by the needs of the design in attaining these requirements.

13.07 **Treatment Plant Locations and Access**. The precise treatment plant locations are not specified by this ROD; however, the remedial design shall provide security measures designed to prevent public access.

13.08 **Conveyances.** Necessary easements, agreements or other actions shall be obtained as necessary to maintain the conveyances (pipelines) which carry water from the extraction wells to the treatment plant(s) and from the treatment plant(s) to discharge points such as aquifer injection wells.

14 Treated Water Discharge and Ancillary Technologies

Treated groundwater shall be discharged as follows.

14.01 **Chlorobenzene Plume.** Groundwater shall be re-injected into the aquifers from which it was withdrawn, in such a way as to limit adverse migration of contaminants and plume interactions as per the provisions already given. Aquifer injection shall be accomplished by aquifer injection wells. The hydraulic control afforded by this injection is required to meet the objectives of this remedial action.

14.02 **Benzene Plume.** Treated groundwater from the benzene plume shall be discharged by one of two methods:

- Discharge to the storm drain, and
- Aquifer injection.

Discharge by aquifer injection shall be allowed only if, upon remedial design, the concentrations of total dissolved solids in the extracted water will be low enough to meet regulatory and engineering requirements for aquifer injection. If this is not the case, then the treated groundwater shall be discharged to the storm drain.

14.03 **TCE Plume**. Treated water from the TCE plume shall be discharged by aquifer injection, with the express purpose of creating hydraulic control and gradients to limit the migration of the TCE.

14.04 **Discharge Requirements**. The discharge requirements that shall be attained prior to discharge by any of the applicable discharge methods are identified in Appendix A of this ROD. All ARARs and independently applicable standards pertaining to groundwater discharge shall be attained.

The ISGS levels established in Section 9 of this ROD apply to the in-situ groundwater. However, in order to ensure protectiveness of human health and the environment, and ensure progress toward meeting ISGS levels in-situ in groundwater, treated groundwater shall not be injected into aquifers at the Joint Site as part of this remedial action at concentrations which exceed the ISGS levels.

15 Operation and Maintenance Plan and Remedial Action

15.01 **Operation and Maintenance (O&M) Plan.** An Operation and Maintenance Plan (O&M Plan) shall be written and approved by EPA prior to initiation of the remedial action. The O&M plan shall establish, at a minimum, all operating aspects, maintenance requirements, schedules, efficiency checks and tests, contingencies, monitoring requirements, performance verification, and compliance verification testing required for the implementation of the remedial action. The remedial action shall be implemented in accordance with the EPA-approved O&M Plan.

15.02 **O&M Plan Contents.** The O&M Plan shall address, at a minimum, the following. "System" refers to the treatment plant, conveyances, extraction wells, aquifer injection wells, monitoring wells, and all related equipment, unless otherwise noted.

- System operating procedures and contingencies
- System maintenance requirements
- System maintenance schedule
- Minimum qualifications of system operating and maintenance personnel
- Frequency, procedures, and protocols for testing treatment plant influent, effluent, and mid-treatment streams including specification of all analytes
- Frequency, procedures and protocols for testing, handling and disposing of all waste streams from the System, including specification of all analytes
- Standard shutdown procedures
- Alarms, notification schedule, and emergency shut-down procedures
- All environmental measurements, including but not limited to ambient air and noise levels within and near the System, the procedures, frequency, schedule, and personnel required for such measurements
- Extraction well maintenance, inspection and sampling schedule and protocols, with specification of all analytes

- Injection well maintenance, inspection, and sampling protocols and methods of assessing and increasing efficiency of injection, with specification of all analytes

- Management of all easements necessary for conveyance lines

- Maintenance and inspection of all conveyance lines

- All tests and procedures related to verification of the efficiency of the System

- All tests and procedures related to verification of compliance with ARARs and all other provisions of the ROD

- All tests and procedures related to evaluation of System performance in attaining cleanup standards.

The O&M Plan need not have a structure corresponding directly to these contents.

15.03 **Additional Engineering Documentation.** The following additional documentation shall be required. These plans may be issued separately or as content/sections within the O&M Plan as approved by EPA. The remedial design shall address, detail, and fully identify the contents of these plans. Plans shall meet any applicable EPA guidances and directives for the development of such documents, unless otherwise approved by EPA. All such plans shall be subject to EPA approval.

- *Site Management Plan,* describing the management of the grounds and area in which the system will operate;

- *Health and Safety Plan* in accordance with all regulations of the Occupational Safety and Health Administration (OSHA), including but not limited to standards found at 29 C.F.R.1910.120;

- *Quality and Assurance Plan* and *Field Sampling Plan* for all samples of water collected for purposes of monitoring, effluent or influent testing, or assessment of system design or performance;

- *Pollution Control and Management Plan* for any and all wastes or waste streams associated with the system; this plan shall ensure compliance with all requirements and ARARs in this ROD as well as any independently applicable standards, if any.

- *Construction Quality Assurance Plan*, for construction of the system;

- *Pilot Test Plan*, outlining all procedures evaluations, reports, and activities related to pilot tests which may be necessary during remedial design or remedial action;

- *Start-up Monitoring Plan*, outlining procedures to start up the system and determine that it is fully functional and operational.

The remedial design shall identify other planning documents and elements, as necessary for the successful design of the system.

15.04 **Completion of the Plume Reduction Portion of the Remedial Action.**

The containment of the containment zone will continue indefinitely and this ROD does not envision its shutdown. However, the chlorobenzene plume with concentrations above ISGS levels outside the containment zone will be eliminated. The following shall apply to the determination that the remedial action has attained ISGS levels and is complete. The following provisions apply *only* to the remedial action operating outside the containment zone.

15.04.01 **Engineering Practices, Rebound, and Minimum Compliance Period.** The O&M Plan shall establish a plan for utilizing appropriate engineering practices to ensure that concentrations of contaminants to not rebound above ISGS levels at any point in the plume after shutdown of the hydraulic extraction and treatment system effecting plume reduction. After the shutdown of the system, concentrations of contaminants shall not again rise above ISGS levels for a period of time to be specified in the O&M Plan and approved by EPA. During this time period, the remedial system, including wells, conveyances, treatment, and discharge systems, shall be maintained and ready to be reactivated in the event that concentrations of contaminants rebound to levels above ISGS levels.

15.04.02 **Additional Requirements.** EPA shall establish any additional requirements and conditions as may be necessary to confirm the completion of the remedial action, in addition to those listed here, in the approved O&M Plan.

16 Institutional Controls and Ensuring Short Term Protection

Institutional controls are discussed in Section 11.3. Only the actions selected are stated here. As part of this action, EPA will:

16.01 **Continue Existing Restrictions.** EPA will coordinate with the appropriate agencies regarding the existing legal and regulatory prohibitions and restrictions on groundwater use for the affected groundwater at the Joint Site.

16.02 **Non-Interference Orders.** At EPA's sole discretion and within its authority, EPA will issue administrative non-interference orders to appropriate parties to prevent contaminant sources presently outside the Joint Site from interfering with the remedial action (discussed in Section 11.3);

16.03 **Well Surveys.** Well surveys will be performed to monitor groundwater use within the area of groundwater affected by contamination at the Joint Site. As part of each statutorily-required 5-year review of the remedial action, and at other times as determined necessary by EPA, a well survey shall be performed for (1) the area within which groundwater contamination exists at concentrations exceeding ISGS levels, (2) the area in which pCBSA concentrations exist at detected concentrations, and (3) the area within one-quarter mile of the areas previously identified. Such well surveys shall identify public or private wells which exist, whether or not they are in operation. The well survey shall be a public record on file with EPA Region IX.

16.03.01 **Sampling of Wells.** For each previously-unidentified well identified in each periodic well survey, the well shall be sampled upon EPA's receipt of permission of access to the real property. Results of sampling shall be made available to the well owner as well as to any property owner who requests such results. Analytes for this sampling shall include the contaminants of concern for the Joint Site, including pCBSA.

16.03.02 **Actions If Contamination Is Found.** For each new well sampled as identified by the well survey, if contaminants of concern are found at concentrations exceeding ISGS levels, or if pCBSA is found at any concentration, the following shall occur:

- EPA shall inform the users and owners of the well of the findings, the health risks that may be associated with use of the water and, if appropriate, provide recommendations to the user as to how to avoid or eliminate those risks.

- EPA shall inform the State Department of Health Services, the State Department of Toxic Substances Control, the Regional Water Quality Control Board, and the Office of the Watermaster of the finding and ask that these agencies review the case of the well to see whether action under their own authorities can be used to prevent further exposure to contaminated water.

- EPA may issue non-interference orders, at its discretion, to prevent or limit operation of wells which may be found to exist within the contaminated groundwater at the Joint Site in the future.

14. Statutory Determinations

The following statutory determinations apply to the remedial action selected by this ROD for the dual-site groundwater operable unit for the Joint Site. Previous sections provide much of the detail often expected in this section. For brevity, those sections are referenced as appropriate.

14.1 Protection of Human Health and the Environment

The remedial action selected by this ROD is protective of human health and the environment. The groundwater at the Joint Site, should it ever be used, would present an unacceptable risk. Because the groundwater continues to move, new portions of the resource can become impacted by contamination in the future. The NAPL itself serves as a principal threat which continues to contaminate groundwater. Regulations direct EPA to restore this groundwater to drinking water standards where it is practicable to do so (i.e. these standards are ARARs where not waived). The remedial action EPA is selecting to for the groundwater contamination at the Joint Site eliminates the health threats from contaminated groundwater, restores the maximum practical extent of the groundwater resource to usability, meets ARARs where technically practicable, contains the principal threat, and safely contains contamination with a significant degree of certainty where it is not practicable to meet ARARs.

The remedial action selected by this ROD hydraulically isolates the NAPL so that the largest reasonable portion of the contaminated groundwater can be restored to drinking water standards and to limit the potential for human exposure to contaminated groundwater. The remedial action arrests the further lateral and vertical movement of all dissolved phase plumes. NAPL recovery actions, as selected by subsequent amendment(s) to this ROD, may reduce and limit the potential for NAPL mobility, enhance the long-term effectiveness, and reduce uncertainties in the ability of the actions selected in this ROD to maintain protectiveness of human health and the environment over the long term.

This remedial action restores the groundwater outside the NAPL isolation zone to levels that would be safe to drink or use for any potable purpose. In doing so, it protects the human health of any persons who might come to use groundwater, either now or in the future, and eliminates the dissolved phase contamination in groundwater outside the containment zone. As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. Because of this, all alternatives considered in the remedy selection process provided a threshold level of protection of human health and the environment, but also provided a range of protectiveness in

terms of long-term certainty of attaining ISGS levels (drinking water standards) at all points in the groundwater that are subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining ISGS levels within groundwater outside the NAPL isolation zone. In addition, it provides significant early time performance, meaning to extent practicable, significant reductions in the size of the plume are achieved early in the remedial time frame. This both increases the certainty of long-term protectiveness, and provides the benefits of the remedial action to the greatest possible area, sooner. Because a significant portion of the groundwater resource is usable in a relatively short time frame, there is, over the course of the remedial action, a smaller area of groundwater that continues to pose unacceptable health risks. This means there is less opportunity for anyone over time to make use of water which poses an unacceptable health threat. This provides additional protectiveness to this remedial action. At the conclusion of the remedial action, groundwater at all points outside of the NAPL isolation zone will not pose a risk outside of EPA's 10^{-4} to 10^{-6} excess cancer risk range, nor a non-cancer risk which exceeds a hazard index of 1. Water inside the NAPL isolation zone will be contained, subject to contingent actions if transgressions of containment occur.

The remedial action was selected by considering the potential for interactions and adverse movements among the various distributions of contamination at the Joint Site. The various elements of the remedial action have been selected such that all objectives of the remedial action can be met. In addition to reducing and eliminating the contamination outside of the NAPL isolation zone, this includes safely and reliably containing the NAPL isolation zone and limiting the induction of movement of contaminants which may threaten the objectives of the remedial action. The size and configuration of the NAPL isolation zone, the aggressiveness of cleanup performance and approximate pump rates to be used, and the actions selected (e.g. reliance on intrinsic biodegradation for some areas, active hydraulic extraction for others) have all been selected to strike an appropriate balance among all of these remedial objectives.

As the remedial action progresses, but prior to its completion, there will remain an area of groundwater that would pose a health risk were it used. This remedial action requires periodic well surveys to identify any new groundwater use within the water contaminated by the Joint Site, requires sampling of such wells, and requires that alternative means of water be provided to persons using such water. This, in conjunction with the institutional controls EPA will seek to implement as part of this remedy, will ensure short-term protectiveness as the remedial action is being implemented.

This remedial action is not expected to present any other unacceptable short-term risks or cross-media impacts. All water will be treated to meet ARARs and/or independently applicable standards prior to discharge.

14.2 Compliance with ARARs

This remedial action will comply with all ARARs, except for those ARARs which are being waived as established by this ROD based on technical impracticability. The specific ARARs that shall apply to this remedial action, and the ARARs which are subject to TI waiver, are listed and discussed in Appendix A of this ROD. The TI waiver applies only to groundwater within the TI waiver zone as defined by this ROD.

As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. All alternatives considered in the remedy selection process met the threshold of compliance with ARARs, yet with long remedial time frames, ARAR compliance must be treated in terms of degrees of long-term certainty, rather than absolute certainty. Accordingly, alternative considered provided a range of long-term certainty of attaining in-situ ARARs (e.g. MCLs) at all points in the groundwater that is subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining in-situ ARARs within groundwater outside the NAPL isolation zone. The degree of aggressiveness, performance, pore volume flushing rate, and early time performance of this remedial action enhance the certainty of meeting ARARs in the long term.

As discussed in Sections 8 and 11 of this ROD, there are no ARARs, promulgated or provisional standards, or reliable toxicological surrogate compounds for pCBSA. However, this remedy adopts a ROD standard for injection of groundwater for the contaminant pCBSA, as discussed in Sections 11 and 12 of this ROD.

14.3 Cost Effectiveness

The remedy selected by this ROD is cost-effective. It uses sufficiently aggressive, but not overly aggressive actions given the conditions, acknowledges the impracticability of complete NAPL removal and contains cost-effective means for addressing it, utilizes intrinsic biodegradation to the extent it can be relied upon, and properly configures the TI waiver zone.

In general, in present worth terms, the alternatives which are more aggressive in terms of plume reduction for the chlorobenzene plume cost more. EPA noted that Alternative 3 presented would cost on the order of $26 million, but it provided unacceptable long-term performance, early time performance, insufficient and sporadic pore volume flushing rates, a low degree of certainty of ultimately attaining ARARs, and an extremely long cleanup time. For an additional $5 million (on the order of $31 million), Alternative 4 provides significant long-term and early time performance, significant and well-distributed pore volume flushing, a substantial degree of certainty of

ultimately attaining ARARs, and an much shorter cleanup time. Alternative 5 would cost an additional $10 million, as compared with Alternative 4. Alternative 5 would provide superior performance to Alternative 4 in all ways just discussed. However, the relative improvement in performance from Alternative 4 to Alternative 5 would not be as great as the improvement from Alternative 3 to Alternative 4; while the increase in cost from Alternative 4 to Alternative 5 would be twice as much as the increase in cost from Alternative 3 to Alternative 4. The JGWFS performed an analysis which showed that, solely on the basis of percent of plume removed per dollar spent, Alternative 4 was superior to the other alternatives. Of course, this simple calculation does not take into account all of the more intangible societal benefits of removing the contamination faster, which Alternative 5 would do. EPA believes, however, that Alternative 4 is an appropriate balance in terms of cost-effectiveness among the alternatives.

The remedial action selected by this ROD strikes a reasonable and appropriate balance between cost and meeting remedial objectives. It acknowledges the fact that, on the one hand, the groundwater within the Joint Site is not being presently withdrawn and used by people. At the same time, it recognizes that future groundwater use is possible, that further expansion of the contamination is possible, and that the groundwater is classified by the State of California as having potential beneficial potable use. The health risks posed by the Joint Site groundwater, should it be used in the future, are unacceptable and could be extreme. Action is warranted.

Accordingly, while not requiring that an exceedingly fast, highly aggressive, and costly remedy be implemented, this remedial action achieves a cleanup in a reasonable time frame, achieves substantial early time performance, and provides for substantial pore volume flushing with good coverage. The remedial action meets the ARAR of attaining the MCLs in all groundwater outside the TI waiver zone and does so with substantial certainty of ultimate success.

This remedial action does not unreasonably impose requirements that all groundwater, including that in the NAPL areas, be restored to drinking water standards. EPA has recognized up-front that doing so would not be practicable, and it would prove extremely costly to attempt to do it, only to empirically "prove" that a TI waiver is justified. Rather, EPA has issued the TI waiver in advance, and developed a prudent and cost-effective approach of isolating the NAPL hydraulically. This approach allows the greatest amount of groundwater to be restored to drinking water standards, while not requiring that the impracticable be achieved in the NAPL areas.

This remedial action properly relies upon the existence of natural intrinsic biodegradation in the benzene plume to achieve remedial goals. This greatly lowers the cost of the remedial action compared to an effort in which active remediation of the benzene plume in all units were required. To the extent that intrinsic biodegradation fulfills the purposes for which it is being relied upon, this greatly enhances the cost effectiveness of this remedy.

EPA also has not unreasonably limited the size and characteristics of the NAPL isolation zone. Had EPA not done so, complicated remedial efforts may have been required that would have greatly increased the costs of the remedial action. While costs were not the primary basis for making these adjustments and delineations to the TI waiver zone, the end result is a remedial action that is more cost-effective. EPA has allowed a reasonable NAPL isolation zone to ensure that pumping does not induce NAPL movement. Also, EPA has not imposed multiple tiny NAPL isolation zones separated by areas that theoretically must be "cleaned," when, in all likelihood, the potential for doing so would be minimal or nonexistent.

The costs of containing and reducing the size of the plume in the case of this remedial action are not inordinate compared to other sites where similar actions have been applied. The cost of this remedial action is reasonable in light of the very substantial protection of human health and long-term effectiveness that is afforded by the action.

14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The remedial action selected by this ROD meets the statutory preference to utilize permanent solutions, and apply treatment to the maximum extent practicable. It is not practicable at this time to remove all NAPL from the site; hence the highest degree of permanence, namely, removal of all contamination from the site cannot be attained. However, the NAPL isolation zone has been kept to the smallest reasonable size that is considered safe, and hence the maximum practicable portion of groundwater is subject to treatment. The alternative selected by this remedial action provides a substantial certainty of attaining ISGS standards outside the NAPL isolation zone in the long term. The remedial action would be permanent with respect to any groundwater areas which are restored to ISGS standards. Accordingly, the maximum practicable area of groundwater is subject to a significant degree of permanence.

While treatment is being employed to remove contaminants from the ground, it is true that groundwater hydraulic extraction and treatment is not, technically, an "alternative treatment technology." However, the size of the contaminant distribution at the Joint Site, and its significant depth across so many hydrostratigraphic units, precludes the use of the more highly innovative technologies now emerging for groundwater cleanup. Likewise, recovery of the contaminant for reuse is not practicable. The groundwater resource, as a whole, is being recovered for use to the greatest practicable extent by this remedial action, however.

It is noted that, in the second phase of remedy selection which will focus on NAPL recovery, both innovative or "alternative" technologies will not only be considered but will be essential; likewise,

recovery of NAPL from the ground, and potential reuse of the NAPL in some way, can be more practicably considered.

14.5 Preference for Treatment as a Principal Element

This remedial action satisfies the statutory preference for treatment as a principal element. Treatment of contamination, which physically removes the contaminant from the site both in terms of mass and volume of water affected, is employed by this remedial action. The principal NAPL threat is isolated and contained by means of hydraulic extraction, treatment, and injection (or discharge). The dissolved phase contamination outside the containment zone is likewise eliminated by means of hydraulic extraction, treatment, and injection (or discharge).

Natural intrinsic biodegradation is relied upon for meeting some of the remedial objectives of this remedial action. While intrinsic biodegradation is not a form of active treatment, it is, in a sense, a treatment in that bacteria are degrading and eliminating contaminant mass just as surely as if EPA had actively applied a man-made treatment. In *relying* on intrinsic biodegradation, EPA is using it as a monitored remedial mechanism. Should this mechanism fail to meet its objective, the ROD calls for active treatment to replace it. Hence, it can be said that the preference for treatment is met by reliance on intrinsic biodegradation, as well.

15. Documentation of Significant Changes

EPA does not consider any changes imposed between the proposed plan and this ROD to be highly significant. For the information of the reader, EPA mentions the following differences, however:

1. The proposed plan identified that one of the performance criteria for the reduction of the chlorobenzene plume would be that the remedial action "remove 50 percent of the plume in 15 years, 70 percent of the plume in 25 years, and 99 percent of the plume in 50 years, as measured by a refined computer model during the remedial design phase of the remedial action, and that progress toward these targets be monitored during the course of the remedial action."

   In the ROD, this requirement was modified to be 33 percent of the plume in 15 years, 66 percent of the plume in 25 years, and 99 percent of the plume in 50 years. These values more closely track the performance that was attributed to the 700-gpm system in the JGWFS.

2. The ROD contains provisions for conducting well surveys during the course of the remedial action. This was not specified in the proposed plan, although as noted by the proposed plan, the ROD does contain many details not listed in the proposed plan, which is intended to be a more general indication to the public as to EPA's intentions with respect to remedy selection.

Appendix A

Identification of Applicable or Relevant and Appropriate Requirements

A.1. Groundwater ARARs

The following legal requirements are determined by this ROD to be applicable or relevant and appropriate requirements (ARARs) for the selected remedial action pursuant to CERCLA Section 121 (d)(2), 42 U.S.C. Section 9621 (d)(2). Only substantive portions of the requirements in the cited provisions below are designated as ARARs for this Record of Decision (as contrasted with administrative requirements, including permitting requirements, which are not ARARs). Where all of an ARAR, or some of the provisions of an ARAR, is/are waived as a result of the technical impracticability waiver of ARARs discussed in Section 10 of the Decision Summary this ROD, it is discussed within the text below in context.

1. DTSC Hazardous Waste Regulations, Title 22 Ch. 14 Article 6 as discussed and specified below.

The DTSC Hazardous Waste Regulations, Title 22, Ch. 14, Article 6 as discussed and specified below. (Implementing relevant portions of the California Hazardous Waste Control Act, California Health and Safety Code Section 2500 et seq. and the Solid Waste Disposal Act, 42 U.S.C. Section 6901 et seq. under EPA authorization pursuant to 42 U.S.C. Section 6926).

The provisions of California Code of Regulations (C.C.R.) Title 22, Chapter 14, Article 6 set out below are relevant and appropriate ARARs for the response actions selected in this Record of Decision. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 2-4 to 2-7 (EPA 540/G-89/006)(August 1988).

Pursuant to 22 C.C.R. Section 66264.94(c),(d) and (e)(1) and the supporting analysis contained in Appendix F of the Joint Groundwater Feasibility Study, concentration limits for the Joint Site are set at the ISGS levels established in Section 9 of the ROD, except where waived below with regard to the Technical Impracticability Waiver Zone. See e.g., Table 9-1.

A. 22 C.C.R. Section 66264.92(a) Water Quality Protection Standard.

This ARAR is waived within the Technical Impracticability Waiver Zone established in this ROD. This waiver is granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for the waiver is contained in Section 10 of this ROD.

B. 22 C.C.R. Section 66264.93 Constituents of Concern and Section 66264.94(a)(3), (c),(d),(e)(1) Concentration Limits.

These sections are waived within the Technical Impracticability Waiver Zone established in this ROD. This waiver is granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4(C). The technical justification for these waivers is contained in Section 10 of this ROD.

In that this ROD finalizes portions of the Del Amo Site Waste Pit Operable Unit ROD, this ROD also selects these sections as ARARs for the unsaturated zone at the Del Amo Site Waste Pit Operable Unit. However, this ROD waives these two ARARs for the unsaturated zone at the Del Amo Site Waste Pit Operable Unit based on the authority and analysis cited above.

These sections are not designated by this ROD as ARARs for the unsaturated zone at the Montrose Site or Del Amo Site outside the Waste Pit Operable Unit. With the exception of the Del Amo Site Waste Pit Operable Unit, the selection of any vadose zone response actions is beyond the scope of this ROD.

C. 22 C.C.R. Section 66264.95(a)(first two sentences only) Monitoring Point and Point of Compliance.

These sections are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD.

As a result, the point of compliance is established at the outer boundaries of the Technical Impracticability Waiver Zone as established in this ROD.

D. 22 C.C.R. Section 66264.97(b)(1)(A), (b)(1)(D), (b)(3-7), (d)(2)(A), (d)(2)(D) General Water Quality Monitoring and System Requirements.

Section 66264.97(d)(2)(A) + (d)(2)(D) are selected as ARARs solely for the purpose of establishing unsaturated zone monitoring requirements for the Waste Pit Operable Unit. As noted above, selection of response actions with respect to the unsaturated zone at the other areas of the Del Amo and at the entirety of the Montrose Site is beyond the scope of this ROD.

E. 22 C.C.R. Section 66264.100(b)(first sentence only), (c)(first sentence), (c)(second sentence- for the Del Amo Waste Pits Operable Unit, as explained below), (d).

Section 66264.100(b)(first sentence) and (c)(first and second sentence) are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD.

Section 66264.100(c) (second sentence) is selected as an ARAR for the Waste Pit Operable Unit. This ROD also determines that response actions, including but not limited to soil and vadose zone cleanup standards, selected in the Waste Pit ROD comply with this ARAR.

Regarding the application of Section 66264.100(d), EPA will base the monitoring program on EPA guidance rather than employ an evaluation monitoring program as set out in Section 66264.99. EPA believes that the EPA guidance is more relevant and appropriate to the circumstances of the Joint Site than are the requirements of Section 66264.99.

2. Other DTSC Hazardous Waste Regulations, 22 C.C.R., as discussed and specified below.

Other DTSC Hazardous Waste Regulations, 22 C.C.R., as discussed and specified below. (Implementing relevant portions of the California Hazardous Waste Control Act, California Health and Safety Code Section 2500 et seq. and the Solid Waste Disposal Act, 42 U.S.C. Section 6901 et seq. under EPA authorization pursuant to 42 U.S.C. Section 6926).

The following provisions of Title 22 of the California Code of Regulations are applicable ARARs for the response actions selected in this ROD[1]. Once it is extracted for treatment, groundwater contaminated with hazardous substances at the Joint Site is classified as hazardous waste, and must be managed accordingly. Once the extracted groundwater is treated to ISGS levels, the groundwater is no longer classified as hazardous waste[2].

---

[1]See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 2-4 to 2-7 (EPA 540/G-89/006) (August 1988). The determination that contaminated groundwater, once it is extracted for treatment, must be managed as state and federal hazardous waste is based on site specific information contained in the Administrative Record for this ROD. See e.g., Section 2 of this ROD and Section 1.3 of the Final Remedial Investigation Report for the Montrose Site (May 1998) (Montrose Site RI Report) regarding the use and releases of hazardous substances at and from the Montrose Plant Property, the Del Amo Plant Property and other nearby properties. See also Montrose RI Report, Chapter 5 and Dames & Moore, Final Remedial Investigation Report; Del Amo Study Area Chapter 5 (May 1998) regarding the concentrations of hazardous substances found at the Joint Site. EPA finds that groundwater which is extracted from the Joint Site for management and treatment in accordance with this ROD is classified as hazardous waste because the groundwater:

- may contain levels of hazardous substances that meet or exceed state and federal hazardous waste toxicity criteria for specific hazardous wastes (including but not limited to RCRA waste # D021 chlorobenzene, D018 benzene, D022 chloroform, D0271,4 dichlorobenzene, and D040 trichloroethylene) and for specific California wastes (including but not limited to DDT and its isomers DDE and DDD). 40 C.F.R. Section 261.24 and 22 C.C.R. Section 66261.24; and

- will contain one or more of the following RCRA listed hazardous wastes-F002 (spent solvents including chlorobenzene), F003 (spent solvents including benzene and xylene), F005 (spent solvents including toluene), and U-listed commercial chemical products, intermediates or off specification products - U019 benzene, U037 chlorobenzene, U061 DDT, U239 xylene, U165 naphthalene, U220 toluene, U228 trichloroethylene, and U056 cyclohexane.

[2]See Memorandum "Status of Contaminated Groundwater and Limitations on Disposal and Reuse" from Sylvia Lowrance, Director Office of Solid Waste, U.S. EPA, to Jeff Zelikson, Director Toxics and Waste Management Division, U.S. EPA Region IX (dated January 24, 1989).

A. 22 C.C.R. Part 261 Criteria for Identifying Hazardous Waste.

B. 22 C.C.R. Section 66262.11 Hazardous Waste Determination by Generators.

C. 22 C.C.R. Section 66262.34 Accumulation Time.

D. 22 C.C.R. Section 66264.13(a)(1), (b) General Waste Analysis.

E. 22 C.C.R. Section 66264.14(a), (b) Hazardous Waste Facility General Security Requirements.

F. 22 C.C.R. Section 66264.15 General Facility Inspection Requirements.

G. 22 C.C.R. Section 66264.17 Hazardous Waste Facility General Requirements for Ignitable Reactive or Incompatible Wastes.

H. 22 C.C.R. Section 66264.18 Location Standards.

I. 22 C.C.R. Section 66264.25 Hazardous Waste Facility Seismic and Precipitation Standards.

J. 22 C.C.R. Section 66264.31 Preparedness & Prevention-Design and Operation of Facility.

K. 22 C.C.R. Section 66264.32 Preparedness & Prevention-Required Equipment.

L. 22 C.C.R. Section 66264.33 Preparedness & Prevention-Testing and Maintenance.

M. 22 C.C.R. Section 66264.34 Preparedness & Prevention-Access to Communications or Alarm System.

N. 22 C.C.R. Section 66264.35 Preparedness & Prevention-Required Aisle Space.

O. 22 C.C.R Section 66264.37 Preparedness & Prevention-Arrangements With Local Authorities.

P. 22 C.C.R. Section 66264.51 Contingency Plan-Purpose and Implementation.

Q. 22 C.C.R. Section 66264.52 Contingency Plan-Content.

R. 22 C.C.R. Section 66264.53(a) Contingency Plan-Copies of Plan.

S. 22 C.C.R. Section 66264.54 Contingency Plan-Amendment.

T. 22 C.C.R. Section 66264.55 Contingency Plan-Emergency Coordinator.

U. 22 C.C.R. Section 66264.56 Contingency Plan-Emergency Procedures.

V. 22 C.C.R. Section 66264.111 Hazardous Waste Facility Closure Performance Standard.

W. 22 C.C.R. Section 66264.112 (a)(1), (b) Closure Plan.

X. 22 C.C.R. Section 66264.114 Hazardous Waste Facility Closure-Disposal and Decontamination of Equipment, Structures and Soils.

Y. 22 C.C.R. Section 66264.117(a)(b)(1) and (d) Hazardous Waste Facility Postclosure Care and Use of Property.

Z. 22 C.C.R. Section 66264.119(a) (regarding notice to the local zoning authority) and (b)(1) Hazardous Waste Facility Post Closure Notices.

AA. 22 C.C.R. Sections 66264.171-178 Use and Management of Containers.

BB. 22 C.C.R. Section 66264.192 New Tanks.

CC. 22 C.C.R. Section 66264.193(b),(c), (d), (e) and (f) Containment and Detection of Releases.

DD. 22 C.C.R. Section 66264.194 General Operating Requirements.

EE. 22 C.C.R. Section 66264.195 Inspections.

FF. 22 C.C.R. Section 66264.196 Response to Leaks or Spills and Disposition of Leaking Or Unfit-for Use Tank Systems.

GG. 22 C.C.R. Section 66264.197 Closure and Post Closure Care.

HH. 22 C.C.R. Section 66264.1052 Standards-Pumps in Light Liquid Service.

II. 22 C.C.R. Section 66264.1053 Compressors.

JJ. 22 C.C.R. Section 66264.1057 Standards-Valves in Gas Vapor Service or Light Liquid Service.

KK. 22 C.C.R. Section 66264.1058 Standards-Pumps and Valves in Heavy Liquid Service.

LL. 22 C.C.R. Sections 66264.1061 and 66264.1062 Alternate Standards.

MM. 22 C.C.R. Section 66264.1063 Test Methods and Procedures.

NN. 22 C.C.R. Section 66264.1101 Containment Buildings-Design and Operating Standards.

OO. 22 C.C.R. Section 66264.1102 Closure and Post Closure Care.

PP. 22 C.C.R. Section 66268.3 Hazardous Waste Dilution Prohibition as a Substitute for Treatment.

This provision is established as an ARAR for any onsite activity that generates a hazardous waste that will be sent offsite for disposal and/or treatment.

3. South Coast Air Quality Management District (SCMD) Rules and Regulations, as specified below

South Coast Air Quality Management District (SCAQMD) Rules and Regulations, as specified below (Implementing relevant portions of Division 26 of the California Health and Safety Code and the Clean Air Act, 42 U.S.C. Section 7401 et seq.).

A. Regulation XIII New Source Review (including but not limited to Rule 1303).

B. Regulation IV, Prohibitions -

i. Rule 401 Visible Emissions,
ii. Rule 402 Nuisance,
iii. Rule 403 Fugitive Dust, and
iv. Rule 473 Disposal of Solid and Liquid Waste.

C. Regulation X NESHAP (Benzene).

D. Rule 1401 New Source Review of Carcinogenic Air Contaminants.

4. Other ARARs, as discussed and specified below

A. State and Federal Maximum Contaminant Levels

As discussed in the ROD, state and federal maximum contaminant levels (MCLs) for hazardous substances found in the groundwater at the Joint Site are established as relevant and appropriate ARARs for the remedial actions selected in this ROD. These ARARs establish both in-situ groundwater cleanup standards and treated groundwater reinjection standards. CERCLA Section 121(d)(2)(A), 42 U.S.C. Section 9621(d)(2)(A) requires that a remedial action attain MCLs where MCLs are determined to be relevant and appropriate. EPA guidance states that MCLs are relevant and appropriate ARARs in situations where the groundwater is or may be used for drinking water. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 4-8 (EPA/540/G-89/006) (August 1988). Although contaminated groundwater at the Joint Site is not currently being used to supply drinking water, the State of California has designated the groundwater bearing units at the Joint Site as potential sources of drinking water. See California Regional Water Quality Control Board, Los Angeles Region, Water Quality Control Plan - Los Angeles Region - Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, Chapter 2 (1994) (implementing S.W.R.C.B. Res. 88-63). Accordingly, EPA in this ROD is selecting the state and federal MCLs set out in Table 9-1 of this ROD as appropriate and relevant ARARs for the remedial actions selected in this ROD. State MCLs are derived from the R.W.Q.C.B Basin Plan which applies specified State standards for chemical constituents to groundwaters that are designated by the Basin Plan as potential sources of drinking water. See California Regional Water Quality Control Board, Los Angeles Region, Water Quality Control Plan - Los Angeles Region at 3-18 (1994).

These MCL ARARs, as in-situ groundwater treatment standards, are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD. However, state and federal MCLs, as ARARs for reinjecting treated groundwater, are not waived inside the Technical Impracticability Waiver Zone. EPA finds that there is no acceptable basis for waiving these ARARs as reinjection standards - given that it is technically feasible to treat the hazardous substances found in groundwater at

the Joint Site to state and federal MCLs and that the lowering, to MCLs, contaminant levels in treated groundwater that is reinjected in the containment zone will not hinder, compromise or complicate the containment measures selected as remedial actions in this ROD.

B. S.W.R.C.B. Resolution 68-16.

State Water Control Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California", is an applicable ARAR with respect to the reinjection of groundwater that has been extracted from the Joint Site as the result of remedial actions required by this ROD.

C. S.W.R.C.B. Regulation, 22 C.C.R. Chapter 15, Article 5, Section 2550.7(b)(5) General Water Quality Monitoring and System Requirements.

D. S.W.R.C.B. Resolution 92-49 Section III. (H).

This Record of Decision does not identify California State Water Resources Control Board Resolution Section III (H) (regarding the establishment of containment zones) as an ARAR for the remedial actions selected in this ROD nor does this ROD rely on this provision as authority for issuing the technical impracticability ARAR waivers previously identified above. However, EPA believes that the Technical Impracticability Waiver Zone for the Joint Site established by this ROD is consistent with S.W.R.C.B Resolution 92-49 Section III (H).

5. Guidance and Advisories To Be Considered

Certain non-promulgated advisories or guidance that are otherwise not legally binding may be identified in a Record of Decision as guidance or advisories "to be considered" (TBC) particularly to aid the design and implementation of the selected remedial actions. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 1-76 (EPA 540/G-89/006) (August 1988). For this Record of Decision the following guidance or advisory is determined to be a TBC for the selected remedy:

South Coast Air Quality Management District, Best Available Control Technology Guidelines Document

A.2. Other Legal Requirements of Independent Legal Applicability

The remedial actions selected in this ROD may trigger additional legal requirements. These requirements are not identified as ARARs in this ROD either because such requirements do not meet the definitional prerequisites (as established by CERCLA Section 121(d)(2)) to be identified as an ARAR for onsite activities or because such requirements are triggered by offsite activities. See generally 42 U.S.C. Section 9621(d)(2). The legal requirements identified below are presented for informational purposes only. Any determination of the legal applicability of such requirements (as well as any implementing regulations) ultimately rests with the governmental entity charged with implementing and enforcing compliance with such requirements.

- CERCLA Section 121 (d)(3), 42 U.S.C. Section 9621(d)(3) requirements regarding offsite disposal of material contaminated with hazardous substances.

- CERCLA Section 103, 42 U.S.C. Section 9603 notification requirements and comparable provisions of California law.

- Provisions of Title 22 of the California Code of Regulations and parallel provisions of federal RCRA regulations relating to offsite shipments of hazardous waste, including but not limited to manifest requirements, pretransport requirements, transportation requirements, and offsite disposal, treatment and land ban prohibitions and requirements.

- Provisions of the California Porter Cologne Act (implementing both state law and the federal Clean Water Act NPDES program) concerning the issuance of waste discharge requirements for point source discharges of treated groundwater water to offsite storm sewer conveyances.

- Federal and State Occupation Health and Safety Act requirements.

- Los Angeles County Sanitation District Wastewater Ordinance, as amended, concerning offsite discharges of treated groundwater to the LACSD sanitary sewer system.

Appendix B

Explanations Pertinent to the Approach to Characterization of Intrinsic Biodegradation for the Benzene and Chlorobenzene Plumes

The following discussion summarizes why (1) EPA did not pursue detailed studies of intrinsic biodegradation rates of the chlorobenzene plume, and (2) EPA did not require highly rigorous direct field measurements of the biodegradation rate for the *benzene* plume. It is important to note that EPA evaluated the potential value of performing extended field studies on chlorobenzene biodegradation, not as to whether such studies could produce useful information, but as to whether the information would be sufficient and accompanied by sufficient certainty to allow for selecting and relying upon intrinsic biodegradation of chlorobenzene in lieu of some other remedial action.

It is noted that showing that a compound can be made to biodegrade in the laboratory under specific conditions does not demonstrate that it is biodegrading in the field at any given location. In principle, field studies could be designed with the intention of evaluating the presence of intrinsic biodegradation of chlorobenzene at the Joint Site. However, the mere presence of intrinsic biodegradation is not a sufficient foundation upon which to base a remedy; rather, it must be shown to be reliable as a remedial mechanism for the long term, in the context of remedial decisionmaking.

In light of the specific characteristics discussed above pertaining to chlorobenzene and the chlorobenzene plume, such studies would have to demonstrate, at a minimum:

1. That intrinsic biodegradation of chlorobenzene is possible and, with significant certainty, by what chemical pathways it occurs;

2. That it is actually occurring in the chlorobenzene plume in all locations in the chlorobenzene plume;

3. That the *rate* of intrinsic biodegradation is sufficient, at all locations throughout the extensive groundwater contamination in the chlorobenzene plume, to attain the remedial objectives of the remedy; and

4. That the rate of intrinsic biodegradation would be reliable for the very long term over

which the remedy will need to be effective, to achieve all remedial objectives.

To accomplish these with a study of chlorobenzene biodegradation, the certainty in the direct field measurements of the rate of intrinsic biodegradation of chlorobenzene at all points in the chlorobenzene plume would have to be extraordinarily high to overcome the fact that most observations about the chlorobenzene plume not only fail to provide support for reliable intrinsic biodegradation of chlorobenzene, but discount it.

Counterposed with this need for high certainty is the fact that studies of the field rate of the intrinsic biodegradation of chlorobenzene at the Joint Site would almost certainly be associated with extraordinarily high *un*certainty. Methods for performing direct field measurements of biodegradation rate require determining the water quality and aquifer characteristics at a (potentially large) number of locations, and measuring how the concentrations change with time between one point and the next. These tests require numerous assumptions and are associated with significant uncertainties. Primary uncertainties among these are associated with (1) attributing the concentration difference from one point to the next as being due to intrinsic biodegradation as opposed to other potential mechanisms, (2) differentiating measured degradation of the target chemical with degradation of another degrading chemical, (3) heterogeneities in aquifer and hydraulic properties, (4) spatial variability in the distribution of geochemical and water quality parameters, (5) temporal variability in the same parameters. The uncertainties in direct field measurements of intrinsic biodegradation rate increase dramatically as:

1. The size of the affected groundwater contaminant distribution increases;

2. The degree of heterogeneity in aquifer parameters and hydraulic parameters increases;

3. The complexity of chemistry in the aquifer (e.g. number of chemicals, etc.) increases;

In large aquifer systems, such studies require significant periods of time (on the order of years) in order to resolve actual concentration changes due to degradation. The time and number of sampling points necessary to run an adequate study of this type increases as the size of the affected groundwater concentration increases. Such studies are more typically run for relatively small groundwater plumes with simple chemistry which can be relatively well-characterized by a reasonable number of sampling points. In most systems, the costs of large numbers of wells in deep hydrostratigraphic units becomes prohibitive.

The extent of the chlorobenzene plume both laterally and vertically, is very large, covering several square miles, extending 1.3 miles from the source and through six hydrostratigraphic units to depths exceeding 200 feet. The aquifers exhibit relatively large heterogeneities and the chlorobenzene plume contains several potentially degradable compounds. All of these factors

imply that relatively high uncertainty would be associated with direct field measurements of intrinsic biodegradation rate in the chlorobenzene plume.

Because multiple and independent lines of evidence support the presence of reliable intrinsic biodegradation in the *benzene* plume, the importance of any single line of evidence, such as direct field measurements of biodegradation rate, is correspondingly less than if it were the *only* line of evidence. In contrast, because there are no independent lines of evidence supporting reliable biodegradation of *chlorobenzene*, direct field measurements would be the *only* means available to provide evidence of such biodegradation. The degree of certainty required to rely on such measurements would therefore be higher, at the very same time that, if such studies were to be performed, the degree of certainty would be much lower for the reasons already discussed.

Given this situation, EPA concluded that, while such studies for the chlorobenzene could produce results which would be of interest, they could not provide a basis for selecting a remedial action that relied on intrinsic biodegradation for the chlorobenzene plume. EPA therefore did not require their performance prior to remedy selection.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

Memo to File - 1999 Record of Decision for the Dual Site Groundwater Operable Unit of the Montrose Chemical and Del Amo Superfund Sites

To: Dana Barton, Branch Manager, California Site Cleanup and Enforcement Branch , Superfund and Environmental Management Division (SEMD)

From: Cynthia Wetmore, Engineer, Site Assessment & Technical Support Section, SEMD

Through: Yarissa Martinez, Remedial Project Manager, California Sites Section II, SEMD
Kelly Manheimer, Section Manager, California Sites Section II, SEMD
Xiao Zhang, Assistant Regional Counsel, Office of Regional Counsel

Re: Clarification of Performance Standards Regarding Hydraulic Extraction and Reinjection in Section 13 of the 1999 *Superfund Record of Decision: Montrose Chemical and Del Amo Sites, OU 3*

The purpose of this memorandum is two-fold: (1) to provide a process for implementing the State of California's Anti-Degradation Policy, State Water Resources Control Board Resolution 68-16 ("SWRCB Resolution 68-16"), which is identified in the 1999 Record of Decision for the Dual Site Groundwater Operable Unit of the Montrose Chemical and Del Amo Superfund Sites ("ROD") as an Applicable or Relevant and Appropriate Requirement ("ARAR") for the selected remedy, and (2) clarify the chlorobenzene plume pump rate provision in the ROD. This memorandum documents these two changes to Section 13 of the ROD, which contains the specifications, standards, and requirements for the remedial action.

Decision Document Rationale

EPA determined that both clarifications described above are nonsignificant or minor changes to the ROD. The first clarification, which adds a list of determinations as Section 13, Provision 9.03.08 of the ROD, provides guidelines for operating the Chlorobenzene Plume treatment system in compliance with SWRCB Resolution 68-16. The second clarification, which adds a paragraph to Section 13, Provision 9.03.02 of the ROD, allows EPA to reduce the 700 gallons per minute (gpm) extraction rate in specific situations. The two clarifications do not change the ARARs, Remedial Action Objectives ("RAOs") or other specifications for the remedial action. The clarifications will not have a significant impact on the scope, performance or cost of the remedy. In accordance with EPA 540-R-98-031, *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, these nonsignificant or minor changes to the ROD are documented in this Memo to the File.

1999 Montrose ROD

In the 1999 ROD, EPA selected remedial actions to address three comingled groundwater plumes at the Dual Site. The ROD requires hydraulic isolation of non-aqueous phase liquid (NAPL), and dissolved phase contamination surrounding the NAPL, in a containment zone, and restoration of the contaminated groundwater outside the containment zone to in-situ groundwater standards ("ISGS"). A main component of the chlorobenzene plume remedy is treatment of the contamination outside the containment zone using hydraulic extraction, treatment, and aquifer reinjection, at a rate of approximately 700 gpm. The ROD sets plume reduction time- and efficiency-based performance requirements.

Section 13 of the ROD provides detailed provisions on how the remedial action should be designed and operated. The ROD provides that "[d]iscretion and latitude shall be preserved in designing the remedy within the range of possible designs meeting the requirements of this section." ROD, Section 13, p. 13-1. The provisions for the chlorobenzene plume remedy include a specific pump rate and a requirement for all provisions to be met:

> 9.03.01 **All of the Provisions Shall Be Met.** No one of these provisions is merely a focus for attaining one or more of the other provisions. All provisions shall be met, even if doing so will result in one or more provisions not only being met but exceeded. As an example, provisions below require a certain pump rate, a certain pore volume flushing rate, and a certain minimum overall rate of reduction of the plume. These provisions independently apply. Thus, even if the minimum rate of reduction of the plume would be exceeded by attaining the pump rate and pore volume flushing rate specified, these shall still be attained.
>
> 9.03.02 **Pump Rate.** Hydraulic extraction shall occur at a combined pump rate of approximately 700 gpm, mostly in the MBFC Sand and the Gage Aquifer. This ROD recognizes that pilot testing, design adjustments, and optimization modeling will occur during the remedial design phase, and the intent of this provision is not to overly limit design. **However, it is intended that hydraulic extraction take place at a rate as close as feasible to the 700 gpm rate shown effective in the feasibility study for Alternative 4, and that this rate be departed from only if shown necessary and if approved by EPA** (emphasis added).

The ROD identified SWRCB Resolution 68-16 as an ARAR in Appendix A to the ROD, Section 4.B. However, the ROD does not include operational specifications to ensure compliance with SWRCB Resolution 68-16.

Status of the Remedial Action

In March 2013, construction began on the groundwater treatment plant for the chlorobenzene plume, which included drilling eight new extraction wells, three new injection wells, and installing associated piping. By December 2014, all components for the groundwater treatment system from the original design were built and installed. In 2015, three short-term functional tests were run on the treatment system. Results from those functional tests indicated upgrades and modifications were needed for several components of the treatment system in order to have the system meet the design requirements. In December 2017, a long-term functional test started, but ended in January 2018 due to injection well issues. This long-term functional test resulted in several pieces of equipment being designed and added to the treatment train, including, but not limited to: ultrafiltration system, contact membrane for dissolved oxygen

removal and a sludge management system. A final functional test started in November 2018 with a focus on treatment system compliance and well capacity. This final functional test is ongoing and is anticipated to conclude in 2020.

Three injection wells are located west of the Montrose property along Francisco Blvd (the “western wellfield”), and four are located east of the Montrose property adjacent to the Del Amo waste pit (the “eastern wellfield”). The wellfields were designed to have treated water injected into the western wellfield at approximately 410 gpm and the eastern wellfield at approximately 290 gpm, to accommodate a total pump rate of 700 gpm.

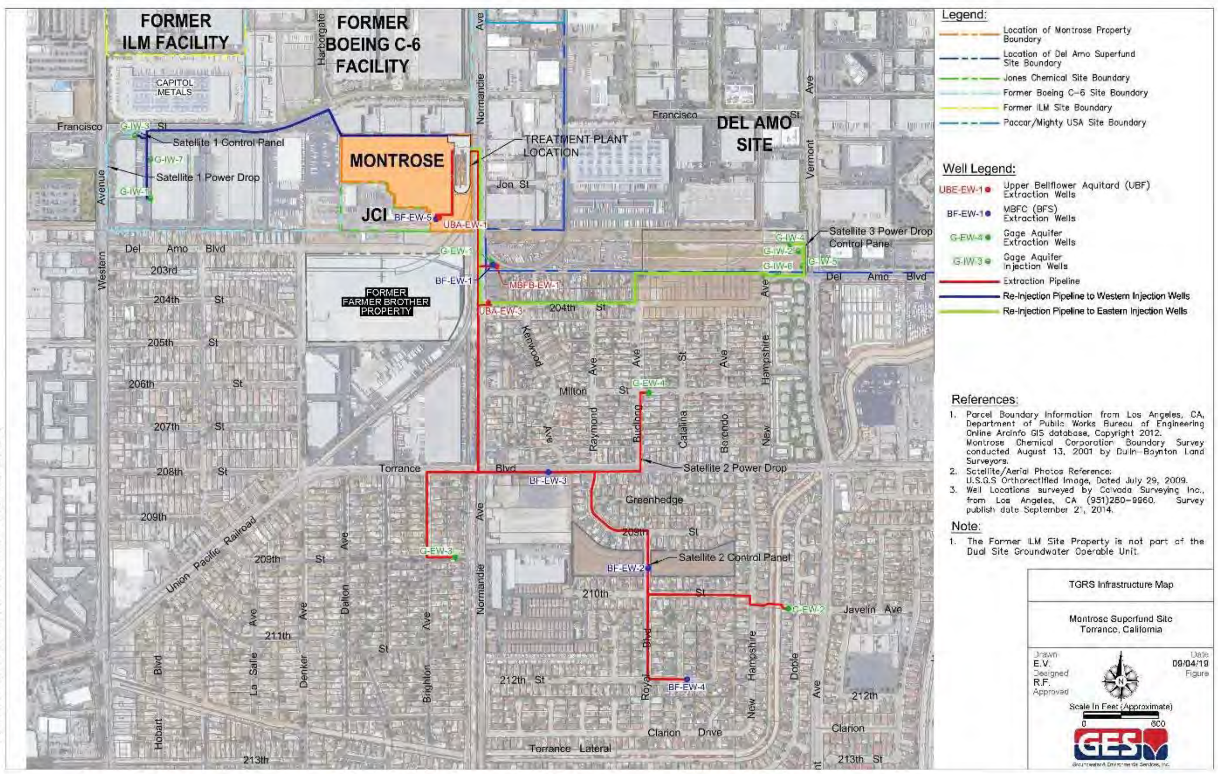


Figure 1. Dual Site Wellfield Infrastructure

Minor Change 1: Compliance with State Resolution 68-16

In EPA’s October 2017 Anti-Degradation Policy Analysis (“2017 ADPA”) for the Dual Site Groundwater Operable Unit of the Montrose Chemical and Del Amo Superfund Sites, EPA analyzed operation of the chlorobenzene plume treatment system for compliance with SWRCB Resolution 68-16. In EPA’s October 2019 Amendment to the 2017 ADPA (“2019 Amendment”), EPA determined that limited use of the eastern wellfield complies with SWRCB Resolution 68-16 if: (1) the eastern wellfield is needed to address ROD noncompliance arising from exclusive reliance on the western wellfield, and (2) the resulting degradation from pCBSA migration is below the degradation resulting from the “maximum use scenario” as described in the 2019 Amendment.

EPA has developed a set of determinations that must be made before treated water can be injected into the eastern wellfield to ensure that operation of the treatment system complies with SWRCB Resolution 68-16, as analyzed in the 2017 ADPA and 2019 Amendment. This memorandum adds the following (in italics) as Section 13, Provision 9.03.08 of the ROD.

> *9.03.08* ***Injection Wellfield Operation and Compliance with S.W.R.C.B. Resolution 68-16****. The injection wellfield must be operated in a manner to recapture the injected treated water to the extent practicable. EPA must make the following determinations prior to permitting any use of the eastern wellfield:*
>
> 1. *Determination that use of the eastern wellfield is needed to address a problem arising due to exclusive use of the western wellfield that may result in non-compliance with this ROD. Examples of such problems include adverse migration, inability to maintain the containment zone, or inability to maintain eastern wellfield equipment.*
> 2. *Determination that the proposed use of the eastern wellfield uses the minimum injection rate and minimum duration needed to mitigate the specific need identified in the first factor.*[1]
> 3. *Determination, based on modeling, that degradation resulting from the proposed use would be less than the degradation caused by the "maximum use scenario" analyzed in the 2019 Anti-Degradation Policy Analysis Amendment.*

EPA will consider all of the following information in making the determinations above:

1. A specific problem that has or may arise due to exclusive use of the western wellfield, such as: adverse migration, inability to maintain the containment zone, or inability to maintain equipment.
2. Specific data demonstrating that the problem identified is either occurring or likely to occur, including modeling, water level measurements, and/or monitoring well data.
3. Estimated duration and flowrate of eastern wellfield injection required to mitigate the need identified.[2]
4. Estimated average effluent concentrations over the duration of injection.
5. Potential solutions and associated costs to mitigate the specific problem identified.[3] If possible, consider at least one option where eastern wellfield injection is not used.
6. Documentation and analysis demonstrating, using modeling, that degradation would be less than the degradation caused by the "worst-case scenario" analyzed in the 2019 Amendment.

---

[1] Routine well maintenance may often be conducted without reinjection of water through the well. All alternatives for well maintenance other than use of the eastern wellfield must be evaluated in accordance with these factors so that the minimum amount of eastern wellfield injection is used.

[2] The extraction and treatment system will be operated in a manner that allows for a range of extraction rates per well, and as a consequence, a range of injection rates should be considered to accommodate the needed flexibility in the extraction wellfield.

[3] Costs can include dollars, time to implement solution, impacts to community or local businesses, etc.

Minor Change 2: Clarity in achieving the ROD provisions

Section 13 of the ROD requires the remedial action to meet the standards, requirements, specifications, and provisions identified in that Section. The ROD allows for some discretion if ROD requirements conflict. For example, Section 13, Provision 10.01 states that "[t]he objective to limit adverse migration of dissolved phase contamination shall not supersede or take preeminence over the other performance provisions of this ROD." ROD, at page 13-20. This instruction provides clarity in implementing the remedy to ensure the more critical provisions are not compromised.

However, not all provisions included instructions on how to prioritize competing requirements, such as the flowrate requirement and compliance with ARARs. For example, Provision 9.03.02, the pump rate provision, states that "this rate be may departed from only if shown necessary and if approved by EPA" without further instructions.

As discussed above, to comply with SWRCB Resolution 68-16, a reduction in reinjection into the eastern wellfield from the estimated design injection rate of 290 gpm will be required. The use of the eastern wellfield will vary over the life of the project and could range from no injection to up to 290 gpm. The ROD specifies that hydraulic extraction for the chlorobenzene plume take place at a rate as close as feasible to 700 gpm, and that this rate be departed from only if shown necessary and if approved by EPA. This memorandum clarifies when it may be necessary to depart from the 700 gpm by adding the second paragraph (in italics) to Section 13, Provision 9.03.02, below:

> 9.03.02 **Pump Rate.** Hydraulic extraction shall occur at a combined pump rate of approximately 700 gpm, mostly in the MBFC Sand and the Gage Aquifer. This ROD recognizes that pilot testing, design adjustments, and optimization modeling will occur during the remedial design phase, and the intent of this provision is not to overly limit design. However, it is intended that hydraulic extraction take place at a rate as close as feasible to the 700 gpm rate shown effective in the feasibility study for Alternative 4, and that this rate be departed from only if shown necessary and if approved by EPA.
>
> *In order to comply with State Resolution 68-16, a hydraulic extraction rate lower than 700 gpm may be necessary because EPA may decide the eastern wellfield should not be used to its full design capacity. If EPA determines the remedial action must use a lower hydraulic extraction rate for this reason, the remedial action must still comply with all other requirements and provisions of the ROD. The hydraulic extraction rate may be reduced by the difference between the design capacity for the eastern wellfield and the eastern wellfield injection flowrate that EPA determines may be used to be in compliance with State Resolution 68-16. The design injection rate of the eastern wellfield is 290 gpm; thus, the maximum reduction to the pump rate is 290 gpm. The hydraulic extraction rate will change during the course of the remedial action as EPA adjusts use of the eastern wellfield. All effort shall be made, including optimization of other discharge options, to achieve a hydraulic extraction rate as close as feasible to the 700 gpm rate.*

Appendix B

(SOW)

CHLOROBENZENE PLUME REMEDY OPERATIONS AND MAINTENANCE

STATEMENT OF WORK

DUAL SITE GROUNDWATER OPERABLE UNIT

MONTROSE CHEMICAL AND DEL AMO SUPERFUND SITES

Los Angeles County, State of California

EPA Region 9

Table of Contents

1. INTRODUCTION

1.1 Purpose of the Statement of Work (SOW). On March 30, 1999, the United States Environmental Protection Agency (EPA) issued the Record of Decision for the Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites (ROD). The ROD selected the remedial action for cleanup of the dissolved-phase contamination and containment of groundwater surrounding non-aqueous phase liquids (NAPL) at both the Montrose Chemical and Del Amo Superfund Sites in Los Angeles, California. The ROD presents EPA's basis for selecting the remedial action, and specifies the standards, requirements, performance standards, and other specifications that shall be attained during the design and implementation of the remedial action selected by the ROD. The remedial standards and requirements are specified in the ROD for the Chlorobenzene, Benzene, and TCE Plumes. In October 2019, EPA issued a Memo to File clarifying requirements in the ROD relating to the hydraulic extraction and reinjection requirements for the Chlorobenzene Plume (hereafter, Flowrate Memo).

This SOW sets forth those activities, collectively referred to as "Work", to be performed by the Settling Defendants pursuant to this Partial Consent Decree ("CD") for operation and maintenance of the Chlorobenzene Plume remedy within the Dual Site Groundwater Operable Unit. The Chlorobenzene Plume groundwater treatment system, referred to as the Torrance Groundwater Remediation System ("TGRS") or "treatment system", and the extraction and injection wellfields were constructed pursuant to the 2012 Construction CD. Settling Defendants shall furnish all necessary and appropriate personnel, materials, and services needed for, or incidental to, performing and completing the Work.

1.2 Structure of the SOW

- Section 2 (Community Involvement) sets forth EPA's and Settling Defendants' responsibilities for community involvement.
- Section 3 (Remedial Action/Operation and Maintenance) sets forth requirements regarding the implementation of the remedy for the Chlorobenzene Plume.
- Section 4 (General Provisions) sets forth general requirements, including but not limited to, requirements for notification, inspections, and off-site shipments.
- Section 5 (Other Work) sets forth additional requirements regarding the implementation of the Work.
- Section 6 (Reporting) sets forth Settling Defendants' reporting obligations.
- Section 7 (Deliverables) describes the content of the required deliverables and the general requirements regarding Settling Defendants' submittal of those deliverables.
- Section 8 (Schedules) sets forth the schedule for submitting the primary deliverables, specifies the supporting deliverables that must accompany each primary deliverable, and sets forth the schedule of milestones regarding the completion of the Work.
- Section 9 (DTSC Participation) addresses participation by the California Department of Toxic Substances Control ("DTSC").
- Section 10 (References) provides a list of references relevant to this SOW.

1.3 The terms used in this SOW that are defined in CERCLA, in regulations promulgated under CERCLA, or in the CD have the meanings assigned to them in CERCLA, in such regulations, or in the CD, except that the term "Paragraph" or "¶" means a paragraph of this SOW, the term "Section" means a section of this SOW, unless otherwise stated, and the term "Work" refers to the collective activities required by this SOW.

For any regulation or guidance referenced in this CD or SOW, the reference will be read to include any subsequent modification, amendment, or replacement of such regulation or guidance. Such modifications, amendments, or replacements apply to the Work only after Settling Defendants receive notification from EPA of the modification, amendment, or replacement; with respect to guidance, any modifications, amendments, or replacements of such guidance apply to the Work only if determined necessary by EPA and after Settling Defendants receive notification from EPA.

1.4 Settling Defendants submitted a draft Operations and Maintenance Manual to EPA on September 23, 2017. EPA provided comments to Settling Defendants on the draft Operations & Maintenance Manual on December 20, 2017. Settling Defendants have subsequently submitted the following attachments to the Draft O&M Manual: Health and Safety Plan (April 10, 2019), Pollution Control Management Plan (May 17, 2019), Emergency Response Plan (April 10, 2019), Field Sampling Plan (August 12, 2019), Quality Assurance Project Plan (August 20, 2019) and Site Management Plan (May 31, 2019).

In addition, Settling Defendants have submitted a draft Data Management Plan (December 18, 2017), Revised Monitoring and Aquifer Compliance Work Plan (July 10, 2019) and Groundwater Modeling Workplan (June 28, 2019).

2. COMMUNITY INVOLVEMENT

2.1 Community Involvement Responsibilities

(a) EPA shall be the lead for developing and implementing community involvement activities at the Montrose Chemical Corp. Superfund Site ("Site"). EPA developed a 2018 draft Community Involvement Plan for the Site. Pursuant to 40 C.F.R. § 300.435(c), EPA is reviewing and finalizing the draft Community Involvement Plan. The California Department of Toxic Substances Control ("DTSC") may support EPA with community involvement activities, at the request of EPA.

(b) If requested by EPA, Settling Defendants shall assist EPA in implementing community involvement activities, including the following: (1) preparation of information regarding the Work for dissemination to the public, with consideration given to including mass media and/or Internet notification; (2) public meetings that may be held or sponsored by EPA to explain

activities at or relating to the Site; (3) providing access to initial submissions and updates of deliverables to Community Advisory Groups, Technical Assistance Grant recipients and their advisors, and other entities, to provide them with a reasonable opportunity for review and comment; (4) providing support to EPA to maintain, update and refresh public information repositories, and (5) implementing any responsibilities for responsible parties described in EPA's draft Community Involvement Plan. EPA intends to also coordinate with other work groups to also support community involvement activities. All community involvement activities conducted by Settling Defendants at EPA's request are subject to EPA's oversight.

3. REMEDIAL ACTION/OPERATION AND MAINTENANCE

3.1 Remedial Action/Operation and Maintenance Work Plan. Settling Defendants shall submit a Remedial Action/Operation and Maintenance Work Plan ("RA/OM WP") for EPA approval and a revised version of that Plan any time Dual Site conditions warrant or if requested by EPA. Upon EPA's approval of the RA/OM WP, Settling Defendants shall implement the RA/OM WP. Settling Defendants shall develop the RA/OM WP in accordance with the *Guidance for Management of Superfund Remedies in Post Construction*, OLEM 9200.3-105, and in compliance with the ROD sections15.01 and 15.02. The RA/OM WP shall include the following, either in full or incorporated by reference from a previously approved deliverable:

(a) Plans for implementing all Work identified in this SOW or in the RA/OM WP, or required by EPA to be conducted to implement the Work;

(b) Description of Performance Standards and Applicable or Relevant and Appropriate Requirements ("ARARs") required to be met to implement the ROD, description of activities to be performed to provide confidence that Performance Standards and ARARs will be met, description of corrective actions to be implemented in the event that Performance Standards or ARARs are not achieved, and a schedule for implementing these corrective actions;

(c) Description of, and schedule for implementing corrective action in case of systems failure, or danger of imminent failure, including: (i) alternative procedures to prevent the release or threatened release of Waste Material which may endanger public health or the environment or may cause a failure to achieve Performance Standards; (ii) analysis of vulnerability and additional resource requirements should a failure occur; (iii) notification and reporting requirements should systems fail; and (iv) local neighbor notification requirements, if necessary;

(d) Designation of Settling Defendants' Project Coordinator, System Operator/Engineer, Independent Quality Assurance Team, and other key project management personnel, along with lines of authority and descriptions of duties;

(e) A description of the overall management strategy for performing the Work and the responsibility and authority of all organizations and key personnel;

(f) A summary of staffing needs for treatment plant operations, including training and certification requirements;

(g) A description of the proposed general approach to contracting, operation, maintenance, and monitoring as necessary to implement the Work and maintain the minimum annual operation uptime;

(h) Descriptions of and methods for satisfying applicable permitting requirements, if any, and other regulatory requirements;

(i) Description of plans for obtaining any access necessary to complete the Work;

(j) Schedule for completion of the Work;

(k) O&M reporting, including a description of records and reports that will be generated, such as weekly operating logs, laboratory records, records of operating costs, reports regarding emergencies, personnel and maintenance records, monitoring reports, and reports to EPA;

(l) Description of significant material and maintenance needs and anticipated equipment replacement for significant components;

(m) Procedures for Settling Defendants to notify EPA of substantial deviations from the RA/OM WP, and to address deviations with the RA/OM WP upon receipt of notice from EPA; and

(n) Description and analysis of potential remedy problems, potential control strategies or corrective actions and descriptions of any areas requiring clarification.

3.2 Independent Quality Assurance Team. Settling Defendants shall designate an Independent Quality Assurance Team ("IQAT") to provide an independent review for the Work, such as, but not limited to, major redesigns, persistent O&M issues, or inability to meet ROD requirements. The IQAT will be independent of the Supervising Contractor. Settling Defendants may hire a third party for this purpose.

Settling Defendants shall notify EPA of Settling Defendants' designated IQAT. Settling Defendants' notice must include the names, titles, contact information, and qualifications

of the members of the IQAT. The IQAT will have the responsibility to determine whether Work is of expected quality and conforms to applicable plans and specifications. The IQAT will have the responsibilities as described in ¶ 2.1.3 of the *Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties*, EPA/540/G-90/001 (Apr. 1990).

3.3 **Operation and Maintenance Manual.** The O&M Manual serves as a guide to the purpose and function of the equipment and systems that make up the remedy. Settling Defendants shall submit an O&M Manual for EPA review and approval.

During operation of the TGRS, Settling Defendants shall continually update the O&M Manual in the field, as needed. Settling Defendants shall submit a revised O&M Manual, in whole or in parts, as directed by EPA. Settling Defendants shall develop the O&M Manual in accordance with *Guidance for Management of Superfund Remedies in Post Construction*, OLEM 9200.3-105 (Feb. 2017).

3.4 **Wellfield Performance Optimization Plan.** Settling Defendants shall submit for EPA's review and approval a Wellfield Performance Optimization Plan. EPA will require subsequent revisions to the Wellfield Performance Optimization Plan if the data indicate and EPA determines that the initial extraction rates are no longer capable of achieving the objectives of the ROD, and no less than every five years timed to be submitted one year before the Five-Year Review is required.

The Wellfield Performance Optimization Plan shall provide the target extraction and injection rate ranges for each well and provide analysis demonstrating that the rates will result in ROD compliance.

EPA indicated in the Anti-Degradation Policy Analyses (2017 and 2019) and the Flowrate Memo (2019) that EPA will only allow limited use, if at all, of the eastern injection wellfield. Montrose and EPA believe that the ROD objectives can be achieved at flowrates below 700 gallons per minute (gpm). In accordance with the 2019 Flowrate Memo, if EPA determines the eastern wellfield should not be used at its full design capacity, the target hydraulic extraction and injection rates of 700 gpm will be reduced by the difference between the design capacity (290 gpm) for the eastern injection wellfield and the eastern wellfield injection flowrate that EPA determines may be used to be in compliance with State Resolution 68-16, subject to the following:

(a) Settling Defendants shall propose extraction and injection rate ranges that operate the TGRS in a manner to maximize flowrate to the extent feasible, including operating selected injection wells above their well-specific design injection rate; and

(b) Extraction and injection rates in excess of the well-specific design capacity shall be considered "feasible" only if they are sustainable over the long-term, do

not significantly increase costs, and do not risk the integrity of the existing infrastructure.

Discharge of treated water from the Chlorobenzene Plume shall be re-injected into the aquifer in such a way as to limit adverse migration and provide hydraulic control. Montrose is not obligated to dispose of treated water via means other than aquifer reinjection.

The Wellfield Performance Optimization Plan shall include, at a minimum, the following, either in full or incorporated by reference from a previously approved deliverable:

(1) A framework/process for optimized pumping rate(s) for the overall remedial system;

(2) The distribution of the range of extraction and injection rates among all wells and/or locations in the overall system, both laterally and vertically among the affected hydrostratigraphic units;

(3) Operational objectives for the various areas of the plume, including but not limited to target extraction rates ranges and their allocation among wells;

(4) Evaluation methodology for determining how the overall system achieves the objectives of the ROD; and

(5) Modeling results and comparison to ROD requirements.

3.5 **Operating Parameters Plan.** Settling Defendants shall submit for EPA's review and approval an Operating Parameters Plan, and a revised version of that Plan at any time Dual Site conditions warrant and/or EPA requires a change in operating parameters.

The Operating Parameters Plan shall specify the minimum annual operating uptime and the operating parameters, including ranges and set points for all key equipment, including wellfields, and the supporting information and analysis. The Operating Parameters Plan shall include a subset of operating parameters and proposed ranges of operation that are key parameters in ensuring the remedy will achieve the objectives set forth in the ROD. The Operating Parameters Plan shall include a table showing the water quality sampling and analysis program for the treatment system, injection wells and extraction wells.

Settling Defendants shall notify EPA in writing, and obtain EPA approval, to operate the treatment system outside the key parameter set points approved as part of the Operating Parameters Plan. Settling Defendants shall amend the Operating Parameters Plan if there is a significant change in the system infrastructure, or if data indicates that the approved Operating Parameters Plan will not achieve the objectives set forth in the ROD.

3.6 **Performance Evaluation and Status Work Plan and Reporting.** Settling Defendants shall submit, for EPA review and approval, a Performance Evaluation and Status Work

Plan ("PESWP") consistent with *O&M Report Template for Ground Water Remedies (with Emphasis on Pump and Treat Systems)*, OSWER 9283.1-22FS (Apr. 2005). The PESWP shall describe how the Performance Evaluation and Status Reports will address all the key components of the treatment system and remedial wellfield and how it will document any noteworthy accomplishments or problems encountered at the treatment facility or with the wellfields. The Performance Evaluation and Status Reports shall document performance of the system, including, but not limited to, achievement of treatment standards and extraction and injection rates, plume containment, etc. If the system is not meeting performance criteria, Settling Defendants shall submit a revision to the appropriate work plan setting forth the actions necessary to bring the groundwater treatment system into compliance.

The Performance Evaluation and Status Reports must include, at a minimum, the following:

(a) Summary of work performed over the previous period, including significant repair work and non-routine maintenance work as described in ¶ 5.2;

(b) Water quality monitoring data of treated water to verify compliance with Performance Standards, and any additional testing requirements to track the injection of treated water;

(c) Assessment of operational performance of the treatment system and its components, including, but not limited to:

(1) Extraction and injection well performance/issues;

(2) Treatment system performance, including key treatment steps, maintenance conducted, downtime, flows/volumes, upgrades, significant unexpected maintenance, waste generation/disposal, and recommendations for EPA consideration; and

(3) Verification that injection assumptions from the approved Operating Performance Plan are still valid;

(d) Detailed and comprehensive assessment of operational performance of the treatment system with respect to achieving the objectives set forth in the ROD, including, but not limited to:

(1) Update on progress in achieving Performance Standards and Remedial Action Objectives, compared to the requirements and what was projected in the Wellfield Performance Optimization Plan; and

(2) Capture/mass reduction performance, including, but not limited to, consideration of capture zone extent as compared to plume extent,

Transgressions of Containment, plume mass reduction over time, and groundwater model updates.

Settling Defendants shall submit these Performance Evaluation and Status Reports to EPA, per ¶ 8.2, every six months for up to the first three years, as determined by EPA, and thereafter annually. The detailed and comprehensive Performance Evaluation and Status Reports should be submitted every five years, in lieu of the annual Performance Evaluation and Status Reports, per ¶ 8.2. The detailed and comprehensive report shall provide detailed analysis for elements in ¶ 3.6 (d), in addition to the elements in ¶ 3.6 (a), ¶ 3.6 (b), and ¶ 3.6 (c).

The Performance Evaluation and Status Report may be combined with the annual Monitoring and Aquifer Compliance Report, discussed below in ¶ 6.2 and ¶ 3.9. As requested by EPA, Settling Defendants shall participate in technical meetings to discuss the performance evaluation and monitoring programs.

3.7 **Groundwater Model Work Plan and Report**. The groundwater model will be used to optimize the remedial wellfield, including the extraction and injection rate allocation by well, and to assist in verification that the remedy is complying with Performance Standards. Settling Defendants shall update the existing groundwater model after sufficient operating time passes, not to exceed one year of steady state operation, to allow for a check on the calibration of the existing model. In addition, Settling Defendants shall update the existing groundwater model at the request of EPA for achieving ROD compliance if site conditions are materially different or if there are significant changes to the understanding of the site conceptual model. The updated groundwater model shall be used to support a determination that the system will meet Performance Standards, and for optimization during the life of the project.

Settling Defendants shall submit a Groundwater Model Work Plan for EPA review and approval. The Groundwater Model Work Plan shall address, as appropriate:

(a) Development of an updated conceptual site model, if determined necessary by EPA;

(b) Identification of, and proposed changes to, elements in the existing groundwater model that may require modifications, such as:

(1) Evaluation and expansion of model domain and revision of boundary conditions;

(2) Refinement and update of source terms, including mass flux of para-chlorobenzene sulfonic acid (pCBSA); and

(3) Incorporation of data reflecting current conditions, as documented in the most recent Monitoring and Aquifer Compliance Report;

(c) Simulation of plume capture zones using the revised model, and comparison of model-simulated and field-measured water levels, hydraulic gradients, and contaminant concentrations;

(d) Complete documentation of inputs into, and outputs of, the flow and transport model; and

(e) Preparation, contents and schedule for completion of a Groundwater Model Report documenting the changes to the model and conclusions.

Settling Defendants shall keep EPA informed and request EPA's input on all significant modeling efforts, including modeling code and software used. Settling Defendants shall submit to EPA modeling memoranda, including their approach to updating the conceptual site model. Settling Defendants shall make available all modeling input and output files to EPA. The updated/recalibrated model shall be fully documented in a Groundwater Model Report that Settling Defendants shall submit to EPA for approval.

3.8 Data Management Plan. Settling Defendants shall submit, for EPA's approval, a Data Management Plan to address all data acquired during the Work, including historical groundwater data assimilated into the process as well as new groundwater data that will be generated by Settling Defendants under this SOW. Settling Defendants shall manage all data in accordance with the approved Data Management Plan.

Settling Defendants shall amend this plan, as directed by EPA, as necessary to address new types of data as they become available. The Data Management Plan shall present the methods for tracking, storing, querying, and retrieving data, the format in which data will be available, the manner of updating the data as new data is acquired, and the means of maintaining data so that modified evaluations can be performed. The plan shall also identify the software to be used, data security, data entry control, transcription error control protocols, minimum data requirements, data format and backup data management. The plan shall address electronic as well as paper data and information.

EPA and DTSC shall be granted full access to the database that will be used for the groundwater modeling and Work under this SOW. Settling Defendants shall also ensure the availability of any additional data, information and documents that EPA determines are not necessary to include directly in the database, but nonetheless need to be readily available during the modeling and other activities in this SOW.

The Data Management Plan, as approved by EPA, shall be consistent with and meet requirements identified in the approved Quality Assurance Project Plan (QAPP), per ¶ 5.6(e) and coordinated with the Data Management Plans of the parties that are conducting work related to the TCE Plume or the Benzene Plume ("Other Groundwater Parties"). The Data Management Plan shall include GIS files and other relevant spatial data. Settling Defendants shall, for the Chlorobenzene Plume, integrate into a single database accessible to EPA and DTSC all data and related well information, including nearby production wells and monitoring wells (see ROD Sections 13, 8.03.02 and 4.04).

Settling Defendants shall maintain relevant NAPL-related data and files in this database collected as part of the Chlorobenzene Plume monitoring, which shall be accessible to EPA and DTSC.

3.9 **Monitoring and Aquifer Compliance Work Plan and Reports**. Settling Defendants shall submit a Monitoring and Aquifer Compliance Work Plan (MACP) for the Chlorobenzene Plume for EPA approval. Settling Defendants shall make good faith efforts to coordinate the implementation of the MACP with the monitoring activities for the TCE and Benzene Plumes, as those plumes are defined in the ROD. The MACP shall include a monitoring program and describe the procedures, locations, and frequency of the following:

(a) Performance monitoring activities in fulfillment of the ROD and the RA/OM WP; and

(b) Preparation of Monitoring and Aquifer Compliance Reports (MACR).

The MACP shall be amended over time, at EPA's direction and with EPA's approval, as necessary to ensure ROD compliance. EPA has been coordinating development of the MACP together with DTSC, Settling Defendants, and some of the Other Groundwater Parties.

Settling Defendants shall prepare and submit an MACR for groundwater at least annually, to be submitted no later than February 28th of each year. The MACR shall continue to be an integrated report, in coordination with the Other Groundwater Parties, and to provide information generated by routine groundwater monitoring conducted pursuant to the ROD and the EPA-approved revised MACP and RA/OM WP. Monitoring and sampling requirements under this SOW shall be limited to the remedy for the Chlorobenzene Plume, with the exception of coordinating sampling with the Other Groundwater Parties.

The primary objective of the MACR is to provide data and data analysis required for assessing the performance of the remedial system and compliance with the requirements of the ROD.

3.10 **Work Plan(s) for Modifications to the Existing Monitoring Infrastructure.** EPA may determine that additional monitoring wells or other modifications to the existing monitoring infrastructure are necessary for ROD compliance. In such event, Settling Defendants shall develop, and submit to EPA for review and approval, a work plan that meets the stated objectives in EPA's request for additional well installations or other modifications to the existing monitoring infrastructure. Any Work Plan for Modifications to the Existing Monitoring Infrastructure shall include, but not be limited to, the following major components:

(a) Identification of the property owners at the locations of the proposed wells and any anticipated access issues;

(b) Well construction methods, material and design;

(c) Proposed well development procedures;

(d) Groundwater sampling and analytical procedures;

(e) Revised supporting deliverables, as described in ¶ 5.6, if applicable;

(f) Implementation schedule; and

(g) The proposed content and due date of the Completion Report for the Work Plan for Modifications to the Existing Monitoring Infrastructure.

Other planning documents, such as the MACP, shall be updated, as required by EPA, to reflect the additional monitoring wells or modifications to the existing monitoring infrastructure.

3.11 Work Plan(s) for Modifications to Existing Extraction, Treatment, and Reinjection Infrastructure. As necessary to achieve ROD compliance, system modifications not previously approved in the O&M Manual, including, but not limited to, additional treatment components, modifications to the system treatment train, and additional extraction/injection wells, may be necessary over the course of remedy implementation to satisfy ROD objectives.

In such event, Settling Defendants shall submit a work plan for any non-minor modification or addition, for review and approval by EPA. Any Work Plan for Modification to the Existing Extraction, Treatment, and Reinjection Infrastructure shall include, but is not limited to, the following major components:

(a) Technical analysis/basis for the modification or change;

(b) Proposal for demonstrating that the objectives of the ROD will be met with the change or modification;

(c) Identification of the design deliverables required for the level of design effort needed for approval;

(d) Revised supporting deliverables, as described in ¶ 5.6 of this SOW, if applicable;

(e) Implementation schedule; and

(f) The proposed content and due date of the Completion Report for the Work Plan for Modification to the Existing Extraction, Treatment, and Reinjection Infrastructure.

Other related documents, such as as-built drawings, the O&M Manual, the RA/OM WP, and the Operating Parameters Plan, shall be updated, as required by EPA to reflect the modifications.

4. GENERAL PROVISIONS

4.1 Notifications. If the schedule for any activity described in the Progress Reports, including activities required to be described under ¶ 6.1(g), changes, Settling Defendants shall notify EPA of such change at least seven (7) Days before the original scheduled date of the activity. For unscheduled work, Settling Defendants shall make best efforts to notify EPA with at least seven (7) Days' notice before initiating field work. For urgent or emergency field work, Settling Defendants shall provide verbal notification pursuant to the Emergency Response Plan.

4.2 Meetings and Inspections

(a) **Periodic Meetings.** Settling Defendants shall meet regularly with EPA, DTSC, and others as directed by EPA, and least annually, and on an as-needed basis as directed by EPA. These meetings may be in-person, by telephone or webinar conferences in order to discuss the progress of the Work. Settling Defendants shall distribute an agenda and list of attendees to all attendees at least seven (7) Days prior to each meeting. Settling Defendants shall prepare minutes of the meetings and shall distribute the minutes to EPA for review and approval. Settling Defendants shall conduct periodic telephone calls with EPA, to discuss status of the Work and schedule.

(b) **Inspections.** EPA or its representative will conduct periodic inspections of the Work. EPA will advise DTSC in advance of these inspections, and DTSC may join at its election. At EPA's request, Settling Defendants' Supervising Contractor or other designee shall accompany EPA or its representative during inspections.

Upon notification by EPA of any deficiencies, Settling Defendants shall take all necessary steps to correct the deficiencies and/or bring the Work into compliance with all deliverables approved under this SOW and any approved design changes. If applicable, Settling Defendants shall comply with any schedule provided by EPA in its notice of deficiency.

(c) **Technical Coordination Meetings and Documentation.** Settling Defendants shall consult with EPA as appropriate. Any critical decisions, as identified by EPA, that are made in meetings or conversations with EPA representatives shall be documented in writing by Settling Defendants and submitted to EPA, within seven (7) Days of the discussion, as directed by

EPA. The submittal shall document the decision and the rationale for the decision.

EPA, DTSC and Settling Defendants shall hold regular technical coordination meetings in accordance with the approved RA/OM WP to ensure effective communication between the parties, to allow EPA and DTSC to monitor and ensure progress, to resolve technical and schedule issues, to facilitate EPA and DTSC ability to oversee the work of Settling Defendants, and to encourage discussion of any matters related to compliance with this SOW and CD. In addition, technical reports shall be shared with Other Groundwater Parties as directed by EPA.

4.3 **Contaminant Transgression Reporting**. Within ten (10) Days of receipt of confirmation of monitoring data indicating the actual or potential Transgressions of Containment for the Chlorobenzene Plume, and after approval of the initial Operating Parameters Plan, Settling Defendants shall notify EPA's Project Coordinator and DTSC's Project Manager. Within ninety (90) Days of data confirming the Transgressions of Containment, Settling Defendants shall submit a preliminary Contaminant Transgression Contingency Plan for rectifying the Transgressions for EPA's approval. Settling Defendants shall submit a more detailed Contaminant Transgression Contingency Plan for EPA approval at the direction of EPA.

4.4 **Treatment Plant Operations Deviations Reporting and Response**. In the event that Settling Defendants operate the treatment plant outside the approved key parameters in the Operating Parameter Plan, Settling Defendants shall notify EPA's Project Coordinator and DTSC's Project Manager within seven (7) Days. If the In-Situ Groundwater Standards or Reinjection Standards as established in the ROD are exceeded in the reinjection effluent, Settling Defendants shall notify EPA's Project Coordinator either within twenty-four (24) hours of receiving the preliminary laboratory results, or in accordance with the approved O&M Manual. Within thirty (30) Days of notifying EPA of the deviation, Settling Defendants shall submit for EPA's approval a preliminary Treatment Plant Operations Deviation Plan for rectifying the deviation. Settling Defendants shall submit a more detailed Treatment Plant Operations Deviation Plan for EPA approval at the direction of EPA.

4.5 **Emergency Response and Reporting.**

(a) **Emergency Response and Reporting**. If any event occurs during performance of the Work that causes or threatens to cause a release of Waste Material on, at, or from the Dual Site and that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, Settling Defendants shall: (1) immediately take all appropriate action to prevent, abate, or minimize such release or threat of release; (2) immediately notify the authorized EPA officer, ¶ 4.5 (c), orally; and (3) take such actions in consultation with the authorized EPA officer and in accordance with all applicable provisions of the Health and

Safety Plan, the Emergency Response Plan, and any other deliverable approved by EPA under this SOW.

(b) **Release Reporting**. Upon the occurrence of any event during performance of the Work that Settling Defendants are required to report pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-Know Act (EPCRA), 42 U.S.C. § 11004, Settling Defendants shall immediately notify the authorized EPA officer orally within one business day.

(c) The "authorized EPA officer" for purposes of immediate oral notifications and consultations under ¶s 4.5 (a) and (b), is the EPA Project Coordinator, the EPA Alternate Project Coordinator (if the EPA Project Coordinator is unavailable), or the EPA Emergency Response Unit, Region 9 (if neither EPA Project Coordinator is available).

(d) For any event covered by ¶s 4.5 (a) and (b), Settling Defendants shall: (1) within fourteen (14) Days after the onset of such event, submit a report to EPA describing the actions or events that occurred and the measures taken, and to be taken, in response thereto; and (2) within thirty (30) Days after the conclusion of such event, submit a report to EPA describing all actions taken in response to such event.

(e) The reporting requirements under ¶ 4.5 are in addition to the reporting required by CERCLA § 103 or EPCRA § 304.

4.6 Off-Site Shipments. Settling Defendants may ship hazardous substances, pollutants, and contaminants from the Dual Site to an off-Site facility only if they comply with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Settling Defendants will be deemed to be in compliance with CERCLA § 121(d)(3) and 40 C.F.R. § 300.440 regarding a shipment if Settling Defendants obtain a prior determination from EPA that the proposed receiving facility for such shipment is acceptable under the criteria of 40 C.F.R. § 300.440(b).

(a) Settling Defendants may ship Waste Material from the Dual Site to an out-of-state waste management facility only if, prior to any shipment, they provide notice to the receiving facility and to the EPA Project Coordinator (who will in turn notify the facility's regional EPA contact and request the facility's State representative be notified). This notice requirement will not apply to any off-site shipments when the total quantity of all such shipments does not exceed 10 cubic yards. The notice must include the following information, if available: (1) the name and location of the receiving facility; (2) the type and quantity of Waste Material to be shipped; (3) the schedule for the shipment; and (4) the method of transportation. Settling Defendants also shall notify the state environmental official referenced above and the EPA Project Coordinator of any major changes in the shipment plan, such as a decision to

ship the Waste Material to a different out-of-state facility. Settling Defendants shall provide the notice after the award of the contract for the Work and before the Waste Material is shipped.

(b) Settling Defendants may ship Investigation Derived Waste (IDW) from the Site to an off-Site facility only if they comply with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), 40 C.F.R. § 300.440, EPA's *Guide to Management of Investigation Derived Waste*, OSWER 9345.3-03FS (Jan. 1992), and any IDW-specific requirements contained in the Record of Decision. Wastes shipped off-site to a laboratory for characterization, and RCRA hazardous wastes that meet the requirements for an exemption from RCRA under 40 CFR § 261.4(e) shipped off-site for treatability studies, are not subject to 40 C.F.R. § 300.440.

5. OTHER WORK

5.1 Well Maintenance and Destruction. Settling Defendants shall perform well maintenance on its groundwater monitoring wells that require repair or rehabilitation, well replacement, and proper well destruction, as needed or as directed by EPA. In the event that destruction or replacement of a well or wells is determined necessary by Settling Defendants (or in the event EPA determines that destruction or replacement of a well or wells is necessary and notifies Settling Defendants of such determination in writing), Settling Defendants shall submit, for EPA approval, a Well Destruction Work Plan documenting the following:

(a) The specific reason that each well must be destroyed, a list of any alternatives to destruction (including replacement) that were considered, and the reasons such alternatives were not proposed;

(b) The anticipated schedule for destruction of each well;

(c) Detailed methods and protocols to be used for well maintenance and destruction;

(d) Traffic control and public protection procedures, if applicable;

(e) A description of waste handling procedures and sampling to be performed, if any; and

(f) Other pertinent information regarding the specific field activity.

Upon EPA approval of a Well Destruction Work Plan, Settling Defendants shall destroy and/or replace the subject well or wells. All well destruction procedures shall be in accordance with the applicable State of California guidance for these activities. Upon completion of well destruction activities, Settling Defendants shall provide to EPA a Well Destruction Completion Report. The report shall provide documentation of the field

activities performed, dates that work was performed, difficulties or obstacles encountered and how they were addressed, field decisions made, and any other information pertinent to the destruction of the wells.

5.2 **Treatment System and Infrastructure Maintenance and Repairs.** Settling Defendants shall perform appropriate maintenance and repair for the treatment system and infrastructure as described in the O&M Manual. Settling Defendants shall include, in the Quarterly Progress Reports, a summary of significant repairs and maintenance efforts performed, dates that work was performed, difficulties or obstacles encountered and how they were addressed, and any other pertinent information for the previous quarter. A summary of all significant repair/maintenance conducted shall be included in the Performance Evaluation and Status Reports. The Settling Defendants shall maintain a record of the following:

(a) A running maintenance and repair log for each treatment system and infrastructure component, including repair performed, date of repair, whether the repair or maintenance was routine or unexpected;

(b) A list of spare parts maintained on-site;

(c) A table that lists all major equipment items (e.g., pumps, mixers, blowers) and critical subcomponents that are subject to wear and tear, and would likely require periodic replacement;

(d) A tracking system that documents operating run times, dates that replacement(s) were made, and an estimate of the replacement cycles; and

(e) A record of off-site disposal of Waste Material, including content, frequency, and volume.

5.3 **Los Angeles County Rights-of-Way Compliance with Franchise and Lease.** To the extent that Work required under this SOW occurs within rights-of-way controlled by the County of Los Angeles ("County"), Settling Defendants shall comply with the requirements of the Franchise granted to Montrose for this project. To the extent that elements of work required under this SOW occur on property controlled by the Los Angeles County Flood Control District ("District"), Settling Defendants shall comply with the requirements of any lease entered into between Montrose and the District for this project.

Additionally, Settling Defendants shall notify the County and other relevant authorities of any release or threat of release or unpermitted discharge of Waste Material from the groundwater treatment system facilities within County rights-of-way or District property, and take all appropriate action at their expense to prevent, abate, or minimize such release or threat of release or unpermitted discharge, including all actions that are legally required and required by applicable cleanup standards to investigate, remove or remediate any such release or unpermitted discharge.

5.4 Well Surveys. As part of each statutorily required Five-Year Review of the Remedial Action, and at other times as determined necessary by EPA, Settling Defendants shall perform a well survey for the area within the Chlorobenzene Plume and the area where pCBSA concentrations are detected in the groundwater, as well as a one-quarter mile periphery extending beyond these areas.

Such well surveys shall identify public or private water supply wells that exist, whether or not they are in operation, and their construction and operational parameters (including but not limited to current and historical extraction rates and water quality, well screen depths, and well seal depths) that could impact the effectiveness of the containment system and potentially allow unintentional movement of contaminated groundwater. Settling Defendants shall prepare Well Survey Reports based on the results of these surveys and submit them to EPA for review and approval.

For all inactive wells, including abandoned wells and wells that are on “standby” (wells that are in service but not pumping for prolonged periods of time), Settling Defendants shall determine whether these wells may act as vertical conduits for contaminated groundwater. For wells that Settling Defendants or EPA determine to be potential conduits for contamination, Settling Defendants shall work with the well owner to investigate and propose appropriate mitigation measures to address it. Settling Defendants may request EPA involvement to assist in working with the well owners.

5.5 Report for Public or Private Drinking Water Wells. Settling Defendants shall sample and test selected monitoring and/or production wells identified by EPA for Dual Site contaminants of concern, including pCBSA, at a minimum of once every five years, upon the receipt of permission to access the property. Settling Defendants shall provide results of sampling to the well owner, if requested by the well owner. Analytes for this sampling shall include all contaminants identified as analytes in the MACP for the Dual Site, including pCBSA. Settling Defendants shall prepare an addendum to the MACP with sampling procedures for sample collection from these wells. A brief sampling report shall be prepared, which documents sampling locations, procedures, and results. The Sampling Report may be incorporated into the Well Survey Reports or incorporated into the MACRs.

5.6 Supporting Deliverables. Settling Defendants shall submit each of the following supporting deliverables to EPA for review and approval, except as specifically provided. Settling Defendants shall develop the deliverables in accordance with all applicable regulations, guidance documents, and policies (see Section 10 (References)). Settling Defendants shall update each of these supporting deliverables as necessary or appropriate during the course of the Work and/or as requested by EPA.

(a) **Health and Safety Plan**. The Health and Safety Plan (HASP) describes all activities to be performed to protect on-site personnel and area residents from physical, chemical, and all other hazards posed by the Work. Settling Defendants shall develop the HASP in accordance with EPA’s Emergency Responder Health and Safety and Occupational Safety and Health

Administration (OSHA) requirements under 29 C.F.R. §§ 1910 and 1926. The HASP should cover Remedial Action activities and be updated to cover activities after Remedial Action completion. EPA does not approve the HASP but will review it to ensure that all necessary elements are included and that the plan provides for the protection of human health and the environment.

(b) **Emergency Response Plan**. The Emergency Response Plan (ERP) must describe procedures to be used in the event of an accident or emergency at the Dual Site (for example, power outages, water impoundment failure, or treatment plant failure). The ERP must include:

(1) Name of the person or entity responsible for responding in the event of an emergency incident;

(2) Plan and date(s) for meeting(s) with the local community, including local, state, and federal agencies involved in the cleanup, as well as local emergency squads and hospitals;

(3) Spill Prevention, Control, and Countermeasures (SPCC) Plan (if applicable), consistent with the regulations under 40 C.F.R. Part 112, describing measures to prevent, and contingency plans for, spills and discharges;

(4) Notification activities in accordance with ¶ 4.5(a) (Emergency Release Reporting), above, in the event of a release of hazardous substances requiring reporting under Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-Know Act (EPCRA), 42 U.S.C. § 11004; and

(5) A description of all necessary actions to ensure compliance with ¶s 40 and 41 (Emergency Response) of the CD, in the event of an occurrence during the performance of the Work that causes or threatens a release of Waste Material from the Dual Site that constitutes an emergency or may present an immediate threat to public health or welfare or the environment.

(c) **Field Sampling Plan**. The Field Sampling Plan (FSP) addresses all sample collection activities. The FSP must be written so that a field sampling team unfamiliar with the project would be able to gather the samples and field information required. Settling Defendants shall develop the FSP in accordance with EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies*, EPA/540/G-89/004 (Oct. 1988).

(d) **Site Management Plan.** The Site Management Plan (SMP) addresses how access, security, contingency procedures, management responsibilities, and

alarm/emergency response, stormwater management, dust and air monitoring, and waste disposal are to be handled.

(e) **Quality Assurance Project Plan.** The QAPP augments the FSP and addresses sample analysis and data handling regarding the Work. The QAPP must include a detailed explanation of Settling Defendants' quality assurance, quality control, and chain of custody procedures for all treatability, design, compliance, and monitoring samples. Settling Defendants shall develop the QAPP in accordance with *EPA Requirements for Quality Assurance Project Plans*, QA/R-5, EPA/240/B-01/003 (Mar. 2001, reissued May 2006); *Guidance for Quality Assurance Project Plans*, QA/G-5, EPA/240/R 02/009 (Dec. 2002); and *Uniform Federal Policy for Quality Assurance Project Plans*, Parts 1-3, EPA/505/B-04/900A though 900C (Mar. 2005). The QAPP also must include procedures:

(1) To ensure that EPA and its authorized representative have reasonable access to laboratories used by Settling Defendants in implementing the Work (Settling Defendants' Labs);

(2) To ensure that Settling Defendants' Labs analyze all samples submitted by EPA pursuant to the QAPP for quality assurance monitoring;

(3) To ensure that Settling Defendants' Labs perform all analyses using EPA-accepted methods (i.e., the methods documented in *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILM05.4 (Dec. 2006); *USEPA Contract Laboratory Program Statement of Work for Organic Analysis*, SOM01.2 (amended Apr. 2007); and *USEPA Contract Laboratory Program Statement of Work for Inorganic Superfund Methods (Multi-Media, Multi-Concentration)*, ISM01.2 (Jan. 2010)) or other methods acceptable to EPA;

(4) To ensure that Settling Defendants' Labs participate in an EPA-accepted Quality Assurance /Quality Control (QA/QC) program or another program QA/QC acceptable to EPA;

(5) For Settling Defendants to provide split samples and/or duplicate samples to EPA upon request; and

(6) For EPA to take any additional samples that it deems necessary.

(f) **Pollution Control Management Plan.** The Pollution Control Management Plan (PCMP) addresses how the generated Waste Material, chemicals, and/or reusable materials needed for operation of the remedy are managed, stored and maintained. The PCMP shall include the following:

(1) The appropriate procedures for handling the Waste Material and other materials to minimize waste generation,

(2) The appropriate procedures to ensure that waste discharge from TGRS operations meets the ARARs;

(3) Pollution prevention and mitigation measures; and

(4) Waste management procedures and disposal, in accordance with ¶ 4.6.

5.7 **Periodic Review Support Plan (PRSP)**. At the request of EPA, Settling Defendants shall submit the PRSP for EPA approval. The PRSP addresses the studies and investigations that Settling Defendants shall conduct to support EPA's reviews of whether the Dual Site groundwater remedy is protective of human health and the environment in accordance with Section 121(c) of CERCLA, 42 U.S.C. § 9621(c) (also known as "Five-Year Reviews"). Settling Defendants shall develop the plan in accordance with EPA's *Comprehensive Five-Year Review Guidance*, OSWER 9355.7-03B-P (June 2001), and any other relevant five-year review guidance.

6. REPORTING

6.1 **Quarterly Progress Reports**. Settling Defendants shall submit progress reports to EPA quarterly, or as otherwise directed by EPA. The reports must cover all activities that took place during the prior reporting period, including:

(a) The actions that have been taken toward achieving compliance with the CD;

(b) Any deviations from the approved Operating Parameters Plan or approved Wellfield Optimization Performance Plan, as well as any reductions in flowrate made in accordance with the Flowrate Memo;

(c) A summary of all results of sampling, tests, and all other data received or generated by Settling Defendants;

(d) A description of all deliverables that Settling Defendants submitted to EPA;

(e) An updated schedule, together with information regarding percentage of completion, delays encountered or anticipated that may affect the future schedule for implementation of the Work, and a description of efforts made to mitigate those delays or anticipated delays;

(f) A description of any modifications to the work plans or other schedules that Settling Defendants have proposed or that have been approved by EPA; and

(g) A document/deliverable tracking spreadsheet, and an updated schedule for work to be performed over the next six months.

After three (3) years following the Effective Date, Settling Defendants may request a reduction in frequency of reporting.

6.2 **Reports.** Settling Defendants shall prepare and submit to EPA and DTSC a Performance Evaluation and Status Report on February 28th and on August 28th of the first three years of operation, pursuant to ¶ 3.6 and ¶ 8.2. Annually, Settling Defendants shall prepare and submit to EPA and DTSC an MACR, pursuant to ¶ 3.9(b). The two reports may be combined. As requested by EPA, Settling Defendants shall participate in technical meetings to discuss the performance evaluation and monitoring programs.

6.3 **Periodic Reports.** Settling Defendants shall submit reports, updates to existing plans, or new work plans, as directed by EPA, and based on the assessment of the performance of the remedy and review of the monitoring and operating data. EPA shall provide direction to Settling Defendants in writing, identifying which report, work plan or update to a work plan is required, and shall include a reasonable due date for its submittal.

7. DELIVERABLES

7.1 **Applicability**. Settling Defendants shall submit deliverables for EPA approval or for EPA comment as specified in this SOW. If neither is specified, the deliverable does not require EPA's approval or comment. ¶s 7.2 and 7.3 apply to all deliverables. ¶ 7.4 applies to any deliverable that is required to be submitted for EPA approval.

7.2 **In Writing**. All deliverables under this SOW must be in writing unless otherwise specified.

7.3 **General Requirements for Deliverables.**

(a) Except as otherwise provided in this CD and SOW, Settling Defendants shall direct all deliverables required by this CD and SOW to the EPA Project Coordinator.

(b) All deliverables shall be provided to DTSC in accordance with Section 9.

(c) All deliverables must be submitted by the deadlines in the RA Schedule, as applicable. Settling Defendants shall submit all deliverables in electronic form. Technical specifications for sampling and monitoring data and spatial data are addressed in ¶ 7.5. All other deliverables shall be submitted to EPA in the electronic form specified by the EPA Project Coordinator, unless a hard copy is requested. If any deliverable includes maps, drawings, or other exhibits that are larger than 8.5" by 11", Settling Defendants shall also provide EPA with paper copies of such exhibits, upon request.

7.4 **Approval of Deliverables.**

(a) **Initial Submissions.**

(1) After review of any deliverable that is required to be submitted for EPA approval under the Consent Decree or this SOW, EPA shall: (i) approve, in whole or in part, the submission; (ii) approve the submission upon specified conditions; (iii) disapprove, in whole or in part, the submission; or (iv) any combination of the foregoing.

(2) EPA also may modify the initial submission to cure deficiencies in the submission if: (i) EPA determines that disapproving the submission and awaiting a resubmission would cause substantial disruption to the Work; or (ii) previous submission(s) have been disapproved due to material defects and the deficiencies in the initial submission under consideration indicate a bad faith lack of effort to submit an acceptable deliverable.

(b) **Resubmissions**. Upon receipt of a notice of disapproval under ¶ 7.4(a) (Initial Submissions), or if required by a notice of approval upon specified conditions under ¶ 7.4(a), Settling Defendants shall, within twenty-one (21) Days or such longer time as specified by EPA in such notice, correct the deficiencies and resubmit the deliverable for approval. After review of the resubmitted deliverable, EPA may: (1) approve, in whole or in part, the resubmission; (2) approve the resubmission upon specified conditions; (3) modify the resubmission; (4) disapprove, in whole or in part, the resubmission, requiring Settling Defendants to correct the deficiencies; or (5) any combination of the foregoing.

(c) **Implementation**. Upon approval, approval upon conditions, or modification by EPA under ¶ 7.4(a) or ¶ 7.4(b), of any deliverable, or any portion thereof: (1) such deliverable, or portion thereof, will be incorporated into and enforceable under the CD; and (2) Settling Defendants shall take any action required by such deliverable, or portion thereof. The implementation of any non-deficient portion of a deliverable submitted or resubmitted under ¶ 7.4(a) or ¶ 7.4(b) does not relieve Settling Defendants of any liability for stipulated penalties under Section XVIII (Stipulated Penalties) of the CD.

7.5 Technical Specifications

The Settling Defendants shall maintain a single database accessible to EPA and DTSC for the Dual Site in coordination with the Other Groundwater Parties. The Settling Defendants shall include all data related to the Chlorobenzene Plume remedy in this database. In the event that sampling and monitoring data is required to be submitted to EPA, the data submission shall comply with the Technical Specifications described below:

(a) If requested, sampling and monitoring data should be submitted in standard regional Electronic Data Deliverable (EDD) format. Other delivery methods may be allowed if electronic direct submission presents a significant burden or as technology changes.

(b) If requested, spatial data, including spatially-referenced data and geospatial data, should be submitted: (1) in the ESRI File Geodatabase; and (2) as unprojected geographic coordinates in decimal degree format using North American Datum 1983 (NAD83) or World Geodetic System 1984 (WGS84) as the datum. If applicable, submissions should include the collection method(s). Projected coordinates may optionally be included but must be documented. Spatial data should be accompanied by metadata, and such metadata should be compliant with the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata and its EPA profile, the EPA Geospatial Metadata Technical Specification. An add-on metadata editor for ESRI software, the EPA Metadata Editor (EME), complies with these FGDC and EPA metadata requirements and is available at https://www.epa.gov/geospatial/epa-metadata-editor.

(c) If requested, each file must include an attribute name for each site unit or sub-unit submitted. Consult https://www.epa.gov/geospatial/geospatial-policies-and-standards for any further available guidance on attribute identification and naming.

(d) Spatial data submitted by Settling Defendants does not, and is not intended to, define the boundaries of the Dual Site.

(e) Final deliverables are required to be compliant with Section 508 requirements. The Environmental Protection Agency policy for 508 compliance can be found on the Agency's Directive System identified in section (d) of this clause under policy number CIO 2130.0, Accessible Electronic and Information Technology. Additional information on Section 508, including EPA's 508 policy can be found at www.epa.gov/accessibility.

8. SCHEDULES

8.1 **Applicability and Revisions**. All deliverables and tasks required under this SOW must be submitted or completed by the deadlines or within the time durations listed in the RA Schedule set forth below. Settling Defendants may submit proposed revised RA Schedules for EPA approval. Upon EPA's approval, the revised RA Schedule supersedes the RA Schedule set forth below, and any previously-approved RA Schedules.

8.2 RA Schedule

RA Schedule of Deliverables		
Description of Deliverable	**¶ Ref.**	**Deadline**
RA/OM Work Plan	3.1	Thirty (30) Days after Effective Date of CD
Operation and Maintenance Manual	3.3	As required in the approved RA/OM WP
Wellfield Performance Optimization Plan	3.4	Thirty (30) Days after requested by EPA; subsequent revision as required by EPA pursuant to written notice
Operating Parameters Plan	3.5	Fifteen (15) Days after EPA's approval of the Wellfield Performance Optimization Plan; subsequent revision as required by EPA pursuant to written notice
Performance Evaluation and Status Work Plan	3.6	As required in the approved RA/OM Work Plan
Performance Evaluation and Status Reports	3.6, 6.2	Twice annually, February 28th and August 28th, for one (1) year (Total six (6) biannual reports maximum). Annually, February 28th after three (3) years
Comprehensive Performance Evaluation and Status Report	3.6, 6.2	February 28th, 2024, and every five (5) years thereafter, in lieu of the annual Performance Evaluation and Status Reports
Groundwater Model Work Plan	3.7	As required in the approved RA/OM WP; subsequent revision as required by EPA pursuant to written notice
Groundwater Model Report	3.7	As specified in approved Groundwater Model Work Plan
Data Management Plan	3.8	One hundred eighty (180) Days after Effective Date of CD; subsequent revision as required by EPA pursuant to written notice
Revised Monitoring and Aquifer Compliance Work Plan	3.9	Three hundred and sixty (360) Days after Effective Date of CD; subsequent revision as required by EPA pursuant to written notice
Monitoring and Aquifer Compliance Reports	3.9, 6.2	Annually, by February 28th

Description of Deliverable	¶ Ref.	Deadline
Work Plan(s) for Modification to the Existing Monitoring Infrastructure	3.10	Thirty (30) Days after EPA provides written notice that an addition or modification to the existing monitoring infrastructure is necessary
Completion Report(s) for Work Plan(s) for Modification to the Existing Monitoring Infrastructure	3.10	As specified in approved Work Plan for Modification to the Existing Monitoring Infrastructure
Work Plan(s) for Modification to the Existing Extraction, Treatment, and Reinjection Infrastructure	3.11	Thirty (30) Days after EPA provides written notice that a modification to the Existing Extraction, Treatment, and Reinjection Infrastructure is necessary
Completion Report(s) for Work Plan(s) for Modification to the Existing Extraction, Treatment, and Reinjection Infrastructure	3.11	As specified in approved Work Plan for Modification to the Existing Extraction, Treatment, and Reinjection Infrastructure
Preliminary Contaminant Transgression Contingency Plan	4.3	Within thirty (30) Days of confirming Transgressions of Containment
Contaminant Transgression Contingency Plan	4.3	To be determined by EPA.
Treatment Plant Operations Deviation Plan	4.4	Within thirty (30) Days of after notifying EPA of the deviation.
Release Reporting	4.5	Interim Report due fourteen (14) Days after event. Final Report due thirty (30) Days after event
Waste Determination Technical Memorandum	4.6	Prior to off-site shipment of Waste Material
Well Maintenance, Destruction and Replacement Work Plan	5.1	Thirty (30) Days after EPA provides written notice that well destruction or replacement is necessary
Well Surveys	5.4	Ninety (90) Days after notice by EPA of start of the Five-Year Review
Sampling Report of Public or Private Drinking Water Wells	5.5	Ninety (90) Days after notice by EPA of start of the Five-Year review, or as requested by EPA.
Health and Safety Plan	5.6 (a),	As required in the approved RA/OM WP
Emergency Response Plan	5.6 (b)	As required in the approved RA/OM WP
Field Sampling Plan	5.6 (c)	As required in the approved RA/OM WP
Site Management Plan	5.6 (d)	As required in the approved RA/OM WP
Quality Assurance Project Plan	5.6 (e)	As required in the approved RA/OM WP

Pollution Control Management Plan	5.6 (f)	As required in the approved RA/OM WP

Regular Reports		
Description of Deliverable	**¶ Ref.**	**Deadline**
Periodic Review Support Plan	5.7	Ninety (90) Days after notice by EPA of start of Five-Year Review process
Quarterly Progress Reports	6.1	20th Day of every quarter (January, April, July, October), following Effective Date of CD, or as directed by EPA
Periodic Reports	6.3	To be determined by EPA
Revised Plans, Reports and Manual	7.5	Thirty (30) Days after receiving comments from EPA

9. DTSC PARTICIPATION

9.1 **Copies**. Settling Defendants shall, at any time they send a deliverable to EPA, send an electronic copy of such deliverable to DTSC. EPA shall, at any time it sends a notice, authorization, approval, disapproval, or certification to Settling Defendants, send a copy of such document to DTSC.

9.2 **Review and Comment**. DTSC will have a reasonable opportunity for review and comment prior to any EPA approval or disapproval under ¶ 7.4 of any deliverables that are required to be submitted for EPA approval.

10. REFERENCES

10.1 The following reports, regulations and guidance documents, among others, apply to the Work. Any item for which a specific URL is not provided below is available on one of the two EPA Web pages listed in ¶ 10.2:

1) *A Compendium of Superfund Field Operations Methods,* EPA, Office of Emergency and Remedial Response, EPA/540/P-87/001a, August 1987, OSWER Directive No. 9355.0-14.
2) *American National Standards Practices for Respiratory Protection*, American National Standards Institute Z88.2-1980, March 11, 1981.
3) *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems,* EPA, January 2008 (EPA/600/R-08/003).
4) *CERCLA Compliance with Other Laws Manual*, Two Volumes, EPA, Office of Emergency and Remedial Response, August 1988 (DRAFT), OSWER Directive No. 9234.1-01 and -02.

5) *Comprehensive Five-Year Review Guidance*, OSWER 9355.7-03B-P, June 2001
6) *Construction Quality Assurance for Hazardous Waste Land Disposal Facilities*, EPA, 1986.
7) *Data Quality Objectives for Remedial Response Activities*, EPA, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, EPA/540/G-87/003, March 1987, OSWER Directive No. 9335.0-7B.
8) *Draft: Region 9 Superfund Data Evaluation/Validation Guidance,* EPA, Quality Assurance Office, R9QA/006.1, December 2001.
9) *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*, EPA Region IV, Environmental Services Division November 1, 2001 (revised periodically).
10) *Draft Community Involvement Plan*, 2018.
11) *EPA Region 9, Superfund Record of Decision: Montrose Chemical and Del Amo Sites, OU 3*, March 30, 1999.
12) *EPA Region 9, Memorandum to File, Clarification* of Performance Standards Regarding Hydraulic Extraction and Reinjection in Section 13 of the 1999 *Superfund Record of Decision: Montrose Chemical and Del Amo Sites, OU 3*, October 2019.
13) *General Methods for Remedial Operation Performance Evaluations*, EPA/600/R-92/002, January 1992.
14) *Guidance for Conducting Remedial Investigations and Feasibility Studies*, EPA/540/G-89/004 (Oct. 1988).
15) *Guidance for Management of Superfund Remedies in Post Construction*, OLEM 9200.3-105 (Feb. 2017).
16) *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4, 2006).
17) *Guidance for Management of Superfund Remedies in Post Construction*, OLEM Directive 9200.3-105, February 2017.
18) *Guidance for Quality Assurance Project Plans for Modeling*, EPA QA/G-5M, December 2002.
19) *Guidance on Expediting Remedial Design and Remedial Actions*, EPA/540/G-90/006, August 1990.
20) *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites*, EPA Office of Emergency and Remedial Response (DRAFT), OSWER Directive No. 9283.1-2.
21) *Guide to Management of Investigation-Derived Wastes*, EPA, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, January 1992.
22) *Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements*, EPA, Office of Emergency and Remedial Response, July 9, 1987, OSWER Directive No. 9234.0-05.
23) Measure and Calculations for Volume of Contaminated Medium Addressed with Respect to the Superfund and RCRA Corrective Action Programs, As Tracked by the Office of Enforcement and Compliance Assurance, November 2003
24) *Methods for Monitoring Pump and Treat Performance,* EPA, Office of Research and Development, June 1994 (EPA 600/R-94/123).
25) *Model Development and Wellfield Optimization Report*, EPA 2008.

26) National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, Federal Register 40 CFR Part 300, March 8, 1990.
27) *NIOSH Manual of Analytical Methods*, 2nd edition., Volumes I-VII for the 3rd edition, Volumes I and II, National Institute of Occupational Safety and Health.
28) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, National Institute of Occupational Safety and Health/Occupational Safety and Health Administration/United States Coast Guard/Environmental Protection Agency, October 1985.
29) *O&M Report Template for Ground Water Remedies (with Emphasis on Pump and Treat Systems)*, OSWER 9283.1-22FS (Apr. 2005).
30) *Optimization Strategies for Long-Term Ground Water Remedies*, EPA 542-R-07-007, May 2007.
31) *Overall Operational Design Report Based on Remedial Wellfield Optimization*, *Dual Site Groundwater Operable Unit Remedial Design, Montrose Chemical and Del Amo Superfund Sites, Los Angeles County, California,* EPA, April 2008.
32) *Partial Consent Decree (Construction of the Dual Site Groundwater Operable Unit Treatment System), Civil No. CV 90 3122-R*, United States District Court, Central District of California Western Division, August 22, 2012.
33) *Permits and Permit Equivalency Processes for CERCLA On-Site Response Actions*, February 19, 1992, OSWER Directive 9355.7-03.
34) *Preparation of a Region 9 Field Sampling Plan for Private and State-Led Superfund Projects* (EPA QAMS DCN 9QA-06-93, 1993).
35) *Quality Assurance and Quality Control for Waste Contaminated Facilities,* EPA/600/R-93/182, 1993.
36) *Remedial Design/Remedial Action (RD/RA) Handbook*, EPA, Office of Solid Waste and Emergency Response (OSWER), 9355.0-04B, EPA 540/R-95/059, June 1995.
37) *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA, EPA/240/B-01/003, March 2001, Reissued May 2006.
38) Standards for the Construction Industry, Code of Federal Regulations, Title 29, Part 1926, Occupational Safety and Health Administration.
39) Standards for General Industry, Code of Federal Regulations, Title 29, Part 1910, Occupational Safety and Health Administration.
40) *Superfund Community Involvement Handbook*, EPA, Office of Solid Waste and Emergency Response, April 2005, EPA-540-K-05-003.
41) *Superfund Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties*, April 1990, EPA/540/G-90/001.
42) *Superfund Remedial Design and Remedial Action Guidance*, EPA, Office of Emergency and Remedial Response, June 1986, OSWER Directive No. 9355.0-4A.
43) *Value Engineering* (Fact Sheet), EPA, Office of Solid Waste and Emergency Response, Publication 9355.5-03FS, May 1990.
44) *EPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*, EPA-540-R-00-006, June 2001.
45) *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, EPA-540-R-08-01, January 2017.

46) *Final Design Drawings and Specifications, Dual Site Groundwater Operable Unit, Unilateral Administrative Order No. 2008-04A, Los Angeles, California*, Geosyntec, June 5, 2012.
47) *O&M Report Template for Groundwater Remedies*, EPA 542-R-05-010, April 2005
48) *Uniform Federal Policy for Quality Assurance Project Plans*, Parts 1-3, EPA/505/B-04/900A though 900C, March 2005.
49) *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, ILM05.4,* December 2006
50) *USEPA Contract Laboratory Program Statement of Work for Inorganic Superfund Methods Multi-Media, Multi-Concentration ISM02.4*, October 2016.
51) *USEPA Contract Laboratory Program Statement of Work for Organic Analysis, SOM01.2*, amended Apr. 2007.
52) *USEPA Contract Laboratory Program Statement of Work for Organic Superfund Methods Multi-Media, Multi-Concentration OSM02.4*, October 2016.

10.2 A more complete list may be found on the following EPA Web pages:

Laws, Policy, and Guidance: https://www.epa.gov/superfund/superfund-policy-guidance-and-laws

Test Methods Collections: https://www.epa.gov/measurements/collection-methods

Appendix C

(Description and/or map of the Dual Site)

Case 2:90-cv-03122-DOC-GJS Document 2727-4 Filed 07/09/12 Page 2 of 3 Page ID

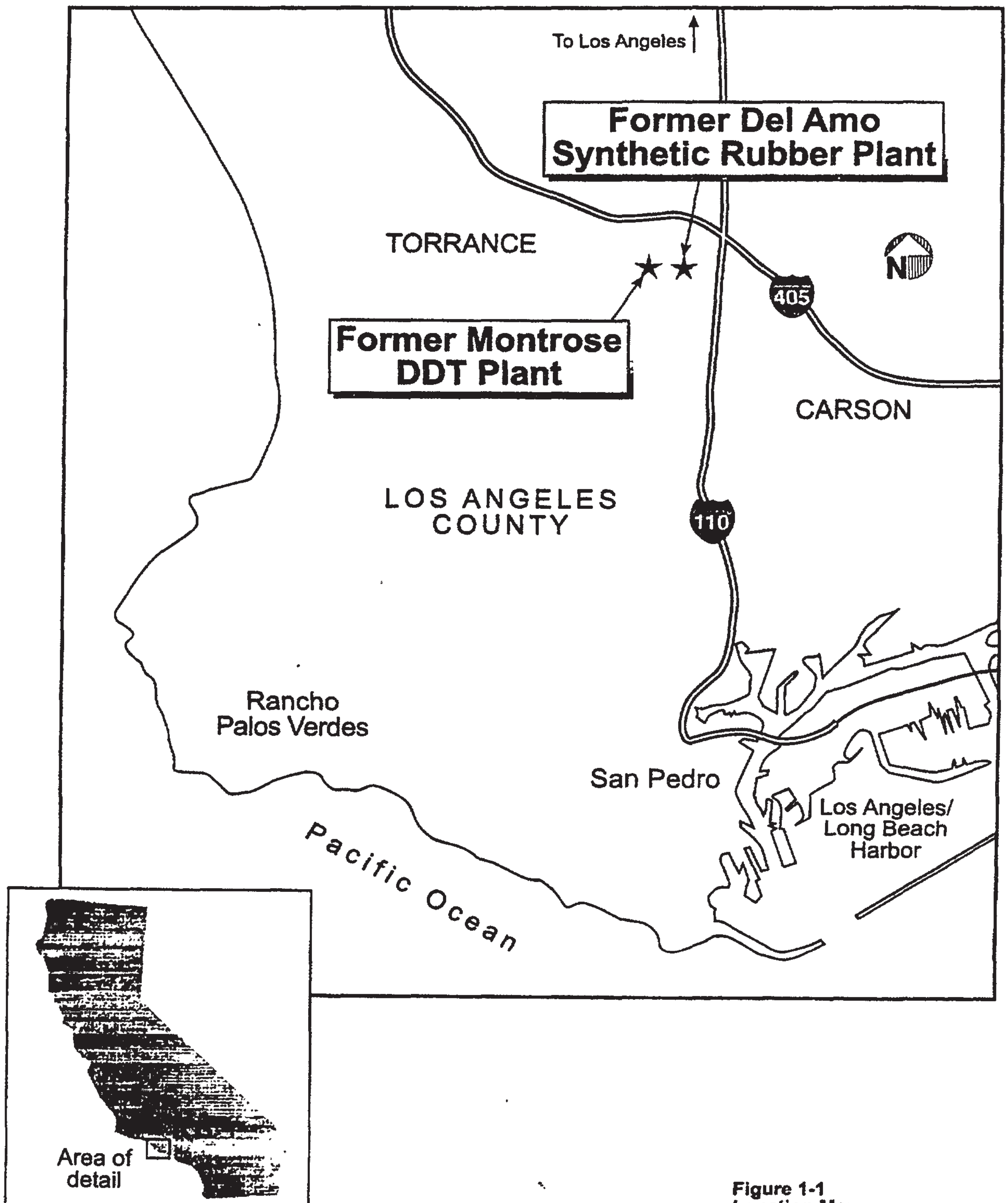


Figure 1-1
Location Map
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

Figure 4

Torrance Groundwater Remediation System Infrastructure Map

Dual Site Groundwater Operable Unit
Los Angeles, California

2019 MACR

TGRS Extraction Wells

- Water Table
- Water Table / MBFB
- MBFB Merged MBFC
- MBFC
- Gage

TGRS Injection Wells

- Gage
- Extraction Piping
- Injection Piping
- Treatment Plant
- Facility as Labeled

N

0 360 720 Feet

1 inch = 700 feet

Figure generated by ddms

DDMS Server Path: R:\Projects\DEF\demax-1547\4173A-Torrance\DataAnalysis\GISData\Projects\MACR\2017 Baseline\Fig09_TGRS.mxd

Appendix D

(form of the performance guarantee)

APPENDIX D – TEMPLATE LETTER OF CREDIT

IRREVOCABLE STANDBY LETTER OF CREDIT

IRREVOCABLE STANDBY LETTER OF CREDIT NUMBER: [**insert number**]

ISSUANCE DATE: [**insert date**]

MAXIMUM AMOUNT: $[**insert dollar amount**]

APPLICANT:
[**Insert name of PRP/Settling Defendant**]
[**Insert contact person(s), title(s), and contact information (address, phone, email, etc.)**]

BENEFICIARY:
U.S. Environmental Protection Agency Region [**insert number**]
c/o [**insert appropriate Regional official such as "Superfund Division Director"**]
[**Insert contact information (address, phone, email, etc.)**]

Dear Sir or Madam:

We hereby establish our Irrevocable Standby Letter of Credit No. [**insert number**] in your favor, at the request and for the account of [**insert name of PRP/Settling Defendant**] (the "Applicant"), in the amount of $[**insert amoun**t] (the "Maximum Amount"). We hereby authorize you, the United States Environmental Protection Agency (the "Beneficiary"), to draw at sight on us, [**insert name of issuing institution**], an aggregate amount equal to the Maximum Amount upon presentation of:

(1) Your sight draft, bearing reference to this Letter of Credit No. [**insert number**] (which may, without limitation, be presented in the form attached hereto as Exhibit A); and

(2) Your signed statement reading as follows: "I certify that the amount of the draft is payable pursuant to that certain [**insert as appropriate:** "Consent Decree," "Administrative Settlement Agreement and Order on Consent," or "Settlement Agreement"], dated [**insert date**], [**insert as appropriate:** civil action number for consent decrees or EPA docket number for administrative agreements], between the United States and [**insert settling parties**], entered into by the parties thereto in accordance with the authority of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675, relating to the [**insert site name [operable unit]**]."

This letter of credit is effective as of [**insert issuance date**] and shall expire on [**insert date that is at least 1 year later**], but such expiration date shall be automatically extended for a period of

[**insert period of at least 1 year**] on [**insert date that is at least 1 year later**] and on each successive expiration date, unless, at least 120 days before the current expiration date, we notify both you and the Applicant by certified mail that we have decided not to extend this letter of credit beyond the current expiration date. In the event you are so notified, any unused portion of the credit shall immediately thereupon be available to you upon presentation of your sight draft for a period of at least 120 days after the date of receipt by both you and the Applicant of such notification, as shown on signed return receipts.

All notifications, requests, and demands required or permitted hereunder shall be given in writing, identify the site, and provide a contact person (and contact information).

Multiple and partial draws on this letter of credit are expressly permitted, up to an aggregate amount not to exceed the Maximum Amount. Whenever this letter of credit is drawn on, under, and in compliance with the terms hereof, we shall duly honor such draft upon presentation to us, and we shall deposit the amount of the draft in immediately available funds directly into such account or accounts as may be specified in accordance with your instructions.

All banking and other charges under this letter of credit are for the account of the Applicant.

This letter of credit is subject to the most recent edition of the Uniform Customs and Practice for Documentary Credits, published and copyrighted by the International Chamber of Commerce.

Very Truly Yours,

Date: ______________

By [signature]: ________________________________
Printed name: ________________________________
Title: ________________________________
Address: ________________________________
Contact information: ________________________________

Exhibit A - Form of Sight Draft
[EPA LETTERHEAD]

SIGHT DRAFT

TO: [**Insert name of issuing institution**]
[**Insert name and title of contact person(s)**]
[**Insert address**]

RE: Letter of Credit No. [**insert number**]

DATE: [**Insert date on which draw is made**]

TIME: [**Insert time of day at which draw is made**]

This draft is drawn under your Irrevocable Standby Letter of Credit No. [**insert number**]. I certify that the amount of the draft is payable pursuant to that certain [**insert as appropriate:** "Consent Decree," "Administrative Settlement Agreement and Order on Consent," or "Settlement Agreement"], dated [**insert date**], [**insert as appropriate:** civil action number for consent decrees, or EPA docket number for administrative agreements], between the United States and [**insert settling parties**], entered into by the parties thereto in accordance with the authority of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675, relating to the [**insert site name [operable unit]**]. Pay to the order of the United States Environmental Protection Agency, in immediately available funds, the amount of $[**insert dollar amount of draw**] or, if no amount certain is specified, the total balance remaining available under such Irrevocable Standby Letter of Credit.

Pay such amount as is specified in the immediately preceding paragraph by [**insert payment instructions as appropriate, such as:** "Fedwire EFT, referencing Site/Spill ID Number [**insert number**] [and DJ Number [**insert number**]]. The Fedwire EFT payment must be sent as follows:

Federal Reserve Bank of New York
ABA = 021030004
Account = 68010727
SWIFT address = FRNYUS33
33 Liberty Street
New York NY 10045
Field Tag 4200 of the Fedwire message should read [D 68010727 Environmental Protection Agency]"]

The total amount paid shall be deposited by EPA in the [**insert site name [operable unit]**] Special Account to be retained and used to conduct or finance response actions at or in connection with the site, or to be transferred by EPA to the EPA Hazardous Substance

Superfund.

This Sight Draft has been duly executed by the undersigned, an authorized representative or agent of the United States Environmental Protection Agency, whose signature hereupon constitutes an endorsement.

By [signature]:	______________________________
Printed name:	______________________________
Title:	______________________________
Address:	______________________________
Contact information:	______________________________